*Bus Bar Conductors, together with other operating articles and regular departments.*

Engineering Library

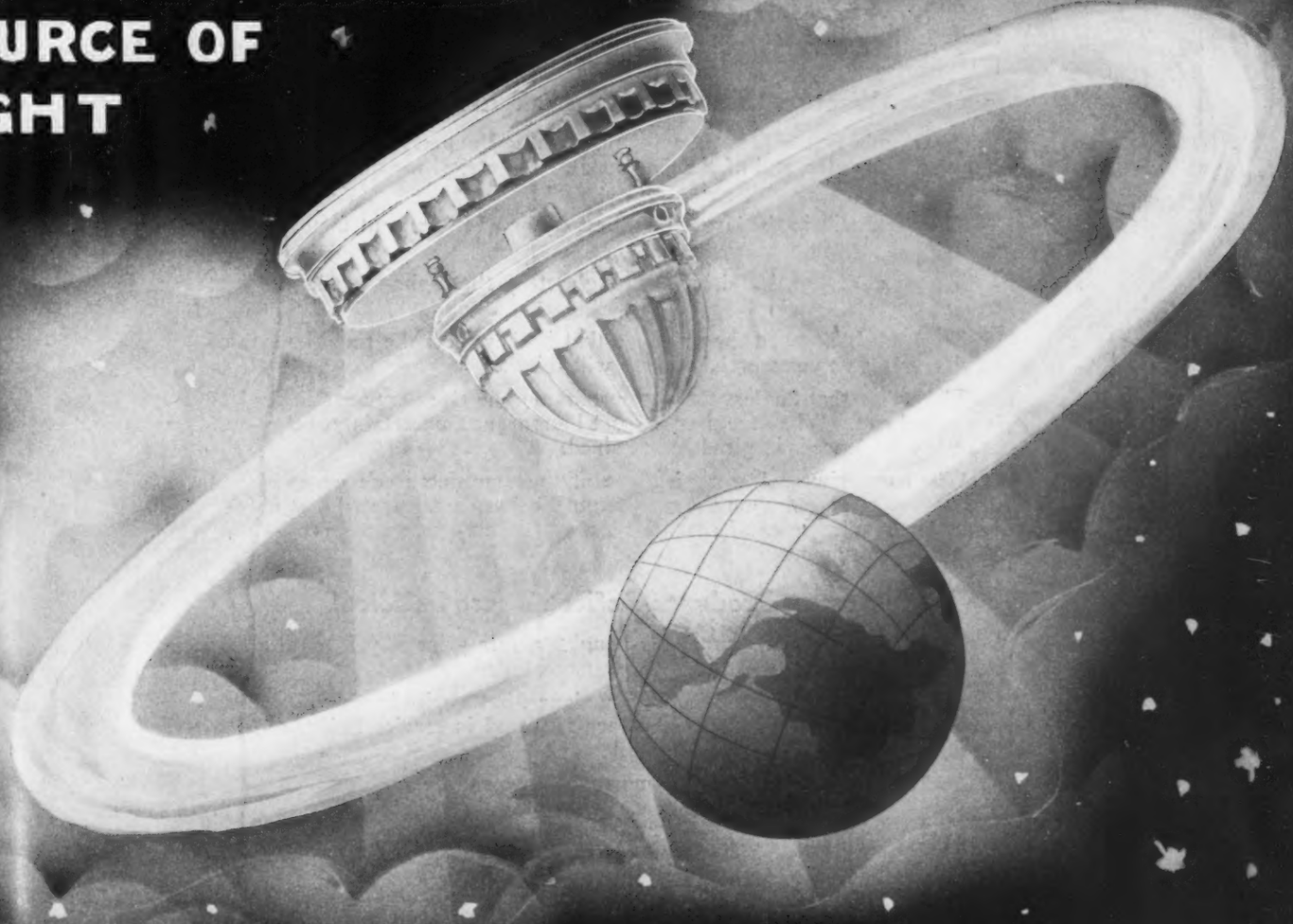
# Electrical World

Volume 67 Number 11 McGraw Publishing Co., Inc. New York, March 11, 1916

PERIODICAL ROOM RECEIVED MAR 11 1916

TRADE MARK
BRASCOLITE
DIFFUSION PLUS REFLECTION
PATENTED

THE WORLDS NEW SOURCE OF LIGHT



LUMINOUS UNIT CO.
ST. LOUIS, U.S.A.

W YORK · 253 BROADWAY
CAGO · 19 S. 5TH AVE.
STON · 223 OLD SOUTH BLDG.
PHILADELPHIA · 1020 LAND TITLE BLDG.
LOS ANGELES · 1621 SOUTH GRAND AVE.
SAN FRANCISCO · 883 MARKET STREET.

Weston

# What the Weston Name Means

Enduring reputation is built only upon the solid rock of public approval—never upon a makeshift foundation.

It is certain that no permanent reputation is maintained unless honesty, ability and progressiveness are behind it.

Whenever supremacy is universally accorded to the product of one manufacturer, it is certain that it is the result of definite principles or policies.

For more than a quarter of a century Weston Instruments have been the foremost exponents of the instrument maker's art.

For more than a quarter of a century they have been the recognized standards of the world.

*They created the art of practical electrical measurement*—for in them and through them that art originated and has been brought to its present-day perfection.

## Weston Instruments Are Built to Serve!

They embody the best thought, research and experimental work of the company's founder, and of the ablest staff of electrical instrument designers in the world.

They are built in the largest and best equipped instrument factory in the world.

They are designed and built throughout by the highest grade and best trained experts.

They are built upon the principle that if they meet the requirements of service, adequate commercial returns will follow.

The policy that "unless the user profits no one else permanently profits" is a sound one. When the user is spared annoyance, uncertainty and cost of upkeep, confidence is inspired and retained.

When experimental work is done at the manufacturer's expense, and no instrument placed upon the market until it has demonstrated that it fully meets the requirements of service, no user will accumulate a scrap-heap of discarded instruments.

## Weston Products Reflect These Policies!

When a Weston Instrument is bought, a fair price is paid for *certain satisfaction.*

Other instruments are made in abundance, but a wise buyer will subject them to the "acid test" of performance rendered in service before making the final selection.

And that is all the Weston Company asks you to do.

**Home Office and Factory**
**Waverly Park, Newark, N. J.**

| | | | | | |
|---|---|---|---|---|---|
| New York | Boston | Chicago | St. Louis | Toronto | Vancouver |
| Philadelphia | Cleveland | Detroit | Denver | Montreal | Paris |
| Buffalo | Cincinnati | Richmond | San Francisco | Winnipeg | Florence |

**Weston Electrical Instrument Co.**

# Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 67 NEW YORK, SATURDAY, MARCH 11, 1916 No. 11

## Concentration of Electrical Supply

DATA published in our news columns this week indicates very clearly to what extent the production of electricity is being concentrated in this country. Statistics published last week showed the central-station output of the country for 1915 to be approximately 18,400,000,000 kw.-hr., a gain of almost 2,000,000,000 over the previous year. In round numbers 13,000,000,000 kw.-hr. was generated by the thirty-six largest companies in the United States, the output of the Commonwealth Edison Company alone being 1,199,000,000. Outside of Niagara Falls, with its great electrochemical industries, which enable one of the companies there to have a yearly load-factor of over 91 per cent, the utilities in the Western States continue to show the highest load-factors. Minus the great manufactories available as loads for Eastern utilities, the central-station managers of the West have shown great ingenuity in making the most of all the opportunities available, with creditable results. Intensive cultivation is at the bottom of their success, and having connected almost all of the houses in their territories for electric service and converted the industries to electric motor drive, these Western managers are now making a play for electric heating and cooking loads. Of the 13,000,000,000 kw.-hr. recorded, more than two-thirds was generated in hydroelectric stations, and we presume when the government discovers that 70 per cent of all of the central-station energy of the country is generated by so few companies, and most of these hydroelectric companies, it will lose sight of the fact that this represents a saving of approximately 15,000,000 tons of coal.

---

## Wiring Campaigns and the Real-Estate Men

AMONG the enterprises whose co-operation will bring business to a town is the real-estate firm. No citizens know more about the advantages of the town's homes than do they. "Wired for electricity" ought to be on the index cards of every house they have for sale or rent. It is significant, when a new resident desires to move into a suburban town, that just as soon as he has bought or rented his home his mail shows that many besides the real-estate man have quickly been made aware of his coming. He gets notices from the coal company, the ice, grocery and meat companies. In one instance the mail also contained a pleasant letter from the pastor of one of the churches welcoming him to the town and calling his attention to that particular church. It is obvious that all these communications came from one source, the real-estate man's office. Why cannot every manager insist that a letter also go from the central-station company? In every case the initiative in getting acquainted has come from the real-estate man. With the "Wire-your-home" campaign as a definite reason for writing, there seems to be a real opportunity to secure the real-estate man's co-operation in developing every resource in town. Just what plan may be used would depend on local conditions. The real-estate men know residences, owners and prospective owners or renters, and their lists are well worth investigation by central-station managers.

---

## Service as Protection Against Competition

THE old adage that to whom much is given from him much is expected is receiving a new application at the hands of public service commissions. Utilities must be awake to their opportunities and must render the service that is expected of them if they desire protection. If they tie up their talent in a napkin, if they are oblivious to advances in the art, if they do not intend to develop their territories adequately and conscientiously, then the commissions, in the interest of the general public, will not feel obligated to render them immune from competition. On the contrary, the commissions will issue a certificate of convenience and necessity to some other company which appreciates the fact that a chance for better service exists. The California commission put the matter bluntly before the utilities of that State in 1912 in the Pacific Gas & Electric Company case; the Pennsylvania commission in recent decisions indicated to the utilities of that commonwealth that there could be no separating of sheep from goats in electric service, and a few weeks ago the New York commission for the Second District issued the following fiat: "No public-service corporation has the right to assume that its natural territory will be kept sacred and inviolate for it alone until such time as it determines that some development should be undertaken therein regardless of the desires or requirements of the public. The wishes and needs of the people are paramount, and when a situation develops where the inhabitants of a community desire to have electricity for use in their homes and to light their streets and they are able to obtain it at satisfactory rates, the commission should aid them in every reasonable way, having at all times, of course, due regard for the rights of all interested parties." The handwriting is plain. The right of protection against competition carries with it the obligation of efficient service at reasonable cost to the public served.

## Experience with Diesel Engines

RESULTS compiled from the performance of Diesel-engine generating stations operated by the Texas Power & Light Company, as presented in this issue, give a valuable insight into the practical working of this type of plant. That the Diesel engine is uniquely efficient in the thermodynamic sense has long been known, and its applicability to use in electric generating stations has been amply demonstrated. Yet, in spite of this, there has been serious distrust of its operating qualities and the mechanical endurance of the outfit under such care as it can reasonably be expected to get in this country. Diesel engines abroad have been justly credited with some very wonderful performances, yet experience has shown that many machines thoroughly successful on the Continent, where fairly high-grade labor is cheaply obtained, do not succeed to the same degree under American conditions. Mr. Burdick, in the presentation of test and operating data, throws a good deal of light on practical facts regarding this situation, most particularly by covering performance of both old and new types of apparatus. The Texas Power & Light Company, which operates a large transmission system, employs eight Diesel-engine stations worked in connection with its general system. These aggregate 5545 hp. in twenty units, varying from 500 hp. down to 170 hp. The company was encouraged to use the Diesel engine on this comparatively large scale because of its great economy in fuel, particularly in the region where fuel oil is cheap, the absence of stand-by charges when the plant is not in operation, and also the facility with which self-contained equipment of this kind may be shifted to another location when the needs of the network require it. Still another important point is brought out in the data derived from tests, that the efficiency of these engines from half load up remains exceedingly good, and even on quarter load is considerably ahead of steam equipment of similar rating.

Of the various stations operated by the transmission company, that at Paris, Tex., is the most recent, and it is to this in particular that most of the data belong. This plant contains three 500-hp. units with a total rating of 1050 kw. in generators. As a preliminary to its installation careful estimates of operative costs were made for the Diesel equipment and for a steam-turbine equipment of substantially the same rating. The latter station complete would have cost about $100 per kilowatt, while the Diesel-engine station cost a little over $145 per kilowatt, practically the same ratio as generally would obtain between a steam and an oil-engine plant of this size. That the fixed charges, therefore, on the Diesel station are comparatively large is obvious. Their estimated amount in this case was 4.85 mills per kilowatt-hour, as against 2.88 mills for the steam station. Figuring the station factor in each case at substantially 50 per cent, the high thermal efficiency of the oil engines pushed them to the front in economy of production in spite of the allowance of greater depreciation. The estimated output costs for the oil engines fell to 4.66 mills per kilowatt-hour, as against 8.56 mills for the steam plant, indicating an estimated annual saving of nearly $9,000 a year. Now, when this estimate was put to the test the results were rather satisfactory. The thermal efficiency reached over 29 per cent at full load and ran from 18 per cent to a shade under 20 per cent even at quarter load. The consumption of fuel oil per kilowatt-hour at full load was 0.6 lb., the B.t.u. per pound averaging about 19,500, and the total production cost as determined on a four months' run proved to be 4.98 mills per kilowatt-hour, a figure very creditably near that estimated. It was found as a matter of experience that the labor item was less serious than has been popularly supposed, and that in engines of first-class modern design mechanical troubles are by no means serious.

A comparative test of the Paris (Tex.) plant and another owned by the company in Tyler, Tex., using four units of 225 hp. each, is particularly instructive. In the latter case second-hand engines were purchased and had been put in order for their new work after six or seven years' service. Of an older design and having been subjected to hard service, they showed an average oil consumption of 1.1 lb. per kilowatt-hour, much greater requirements for maintenance and lubricants, waste and labor, so that the total cost of production per kilowatt-hour rose to 13.6 mills. This is rather high as compared with the new plant and yet not bad compared with a steam plant containing units of a similar size. All this indicates that, when judiciously installed and carefully handled, the Diesel engine is a very efficient and cheap producer of power and that these requirements are not particularly difficult to meet; but when handled by ordinary or inexperienced operators a Diesel-engine plant apparently suffers in efficiency and in maintenance after severe use for a considerable period, as is shown in the case of the Tyler station. It is not surprising, therefore, that Diesel engines fail to give a satisfactory degree of economy, considering first cost, under these conditions. That the internal-combustion engine can fulfill an extremely useful function where conditions are favorable is shown by the author, and the actual working data given in the article before us are exceptionally valuable from the standpoint of practical operation.

---

## Stability of Electric Rates

GASOLINE now costs a third more than it did a few months ago. More than this, a representative of the Standard Oil Company is quoted as saying that gasoline may cost 40 cents a gallon before the summer ends. This rise in price of gasoline motor fuel is worth noting, not alone because it gives at least an unusual temporary advantage in maintenance costs in favor of using electric trucks but because it also calls attention to the stability of the prices for electric energy. The owner of a large fleet of gasoline trucks must not only meet an increase in his fuel cost but must constantly face the question of fluctuating fuel costs. If he uses electric vehicles, he is at least sure that his battery-charging rate will not suddenly rise and throw out his

preliminary calculations for trucking costs. This unusual fluctuation in the price of gasoline calls attention to the dependability of electric service. Average rates for electric energy over a period of years not only are free from unheralded increases but the general tendency, as is well known, is downward. The present price changes in gasoline merely serve to make the contrast between stable and unstable price as an element in costs unusually striking.

## Operation of Interpole Machines

CONSIDERING the number of direct-current machines in every-day use of the interpole type, it is remarkable that this type was almost unknown sixteen years ago. Indeed, the interpole, although experimented with more than twenty-five years ago, was in fairly extended use in France before it was introduced to any appreciable extent in America. The interpole, with proper design, enables the commutation of direct-current machines under heavy loads to be greatly improved.

Modern interpole machines, however, are occasionally subject to difficulties of their own, and one of them is a possible instability of voltage in generators or of speed in motors. The nature and causes of this instability are of considerable importance to operating and purchasing engineers. The subject is dealt with in a very simple and practical manner by Justin Lebovici in an article the first part of which appears in this week's issue.

The article calls attention to the importance of uniform brush spacing and the tests for its determination. This matter is usually overlooked by dynamo men. In well-constructed machines the uniformity of brush-holder spacings may ordinarily be taken for granted, but occasionally, owing to some accident, an unsuspected error in spacing may present itself, and then perhaps with serious influences on the commutation. The method of determining the neutral point by means of a pair of brushes in an insulating spacing handle, applied to the rotating commutator and connected to a millivoltmeter, has been known and used to some extent for many years, but the somewhat similar exploration method between brush and commutator for determining the nature of the commutation is relatively very little known and deserves to be widely disseminated. It is a very simple method and evidently is capable of yielding valuable qualitative results. It would seem that this method might even be capable of being elaborated into a laboratory method of quantitative investigation of the conditions of commutation. Some researches in this direction have already been published. The article by Mr. Lebovici should be carefully read by direct-current dynamo men who desire to be more completely acquainted with the actions occurring in interpole machines.

## Skin Effect in Strap Conductors

IT is surprising how little has been known until very recently concerning the alternating-current skin effect in copper straps or strip conductors, considering how frequently such strips are employed in practice. The theory of indefinitely wide strips was published by Lord Rayleigh nearly thirty years ago, but the experimental observations in the A. I. E. E. paper of Messrs. Kennelly, Laws and Pierce last September seem to have been the first publication of actual measurements on the subject. Those measurements showed that the skin-effect resistance ratios for ordinary sizes of copper strip are many times greater than those to be expected from the theory of indefinitely wide strips.

H. B. Dwight, who has given this matter careful attention, presents an article on the subject in this number. He collects the observations given in the A. I. E. E. paper above mentioned, and shows that the skin-effect resistance ratios of these strips, up to frequencies of 5000 cycles, when plotted as ordinates against a certain specific quantity $\sqrt{f/R}$ as abscissas, where $f$ is the impressed frequency and $R$ the tabular linear resistance of the conductor in ohms per thousand feet, gives a curve which rapidly tends to a straight line. The corresponding curve and asymptotic straight line for round wires are already known.

It is pointed out in the article that, whereas the curve for round wires represents a definite formula, established both by measurement and by theory, the new curve for strips represents only an empirical result based on certain concordant measurements but not established as yet on a definite theory. Moreover, the frequencies employed in the measurements did not exceed 5000 cycles. However, subject to these limitations, the curves offered by Mr. Dwight will be very useful. We understand that the laboratory researches on the skin-effect resistance ratio of strap conductors are being continued.

## The Coming Issues

ERRORS incidental to the use of sphere gaps for the measurement of high alternating-current voltages form the subject of a timely investigation the results of which are reported in the engineering issue of next week — the third number of the ELECTRICAL WORLD for March. In the series of articles on opportunities for young electrical engineers appearing each month, M. C. Rorty of the American Telephone & Telegraph Company contributes to the same issue a discussion of the openings for the technical graduate in the telephone field. The following week, in the monthly commercial issue dated March 25, some of the greater opportunities of the "Wire-your-home-month" campaign will be pointed out, with detail plans by which central station and contractor and manufacturer and dealer can capitalize this month's activity into even more extended commercial profit. Electric-sign campaigns, interior lighting, the engineering of wiring lay-outs, etc., are among the other commercial topics to be treated in this number. The first issue of April is the public-relations number of that month, and will be followed in the usual order by the number featuring station operation under date of April 8.

Chronicle of Events of the Industry and of Important Movements in the Field

# NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

## Shields Bill Passes Senate

**Measure Must Still Come Up in House of Representatives—Ferris Bill Yet Awaiting Action in Senate**

The Shields bill, authorizing the Secretary of War to grant fifty-year permits for the building of dams and water-power plants on navigable streams, passed the Senate Wednesday. Senator Newlands' amendment, which provides for a waterways commission which shall have power to deal with water-power matters, was voted down.

This is the first vote taken by the Senate on a general water-power development measure in the eight years that the subject of conservation of natural resources has been under consideration in Congress. Two water-power bills passed the House last year and died in the Senate. Senate leaders and military authorities urged the Shields bill as a vital feature of the preparedness program.

It is estimated that there is 60,000,000 hp. of natural energy in the navigable streams of the United States, of which nine-tenths is flowing to waste. These great water-powers have been locked out of use up to now, as a special act of Congress has been necessary for each power plant and it has been impossible to pass workable acts for the development of large water-powers.

Senator Shields of Tennessee announced in the Senate that the passage of this bill would be followed by early development of water-powers aggregating 15,000,000 hp., or a volume of electricity equal to that produced by a coal consumption of 100,000,000 tons a year. Engineers estimate that development of this amount of water-power would equal a saving of $700,000 a day in coal bills.

It is known that a number of big electrochemical plants for making saltpeter and nitric acid from the air have been planned by private enterprise and will be built as soon as the Shields bill becomes a law and makes it possible to finance these undertakings.

Electrification of railroads, manufacture of iron and steel in electric furnaces and extensive irrigation developments in the West are among other benefits expected to be derived from the utilization of large water-powers for generation of cheap electricity.

Under the terms of the Shields bill, the Secretary of War is authorized to grant permits for dams and power plants where he believes the building of such dams will improve navigability of streams. Dams are to be built without cost to the government, and the grantees are to provide and operate locks, gates, sluiceways, etc., all without cost to the government. Permits may be granted to individuals, political subdivisions of states, cities or other municipal corporations, or to public-utility corporations. Intrastate business and rates of companies operating under the act are to be regulated by the states, and interstate service and rates by the Interstate Commerce Commission.

All plans for dams and works are to be approved by the War Department, as being the most adaptable plans for improvement of navigation and fullest development of water-power possibilities. The grantee is to pay a rental for public lands used and a charge for rights and privileges in use of water, these rentals and charges to be fixed at the discretion of the Secretary of War and the money received from them to go into a special fund in the United States Treasury, to be used for further improvement of waterways. Actual construction work on any project is to be begun within two years of the granting of the permit, and the works are to be completed within such reasonable time as the Secretary may prescribe. For failure to complete the works as directed, or for violation of the provisions of the act or non-compliance with regulations or orders of the War Department, the grantee is subject to heavy cash penalties or to revocation of the grant.

Permits are to be granted for fifty years, after which time the government may either extend the original lease, make a new grant, or upon one year's notice take over the property upon payment of its fair value, this value to be determined by mutual agreement or by the federal courts, and not to include any allowance for rights granted by the government. The bill also provides that no value of rights granted by the government shall be allowed in fixing rates to consumers. Dams, locks and other structures used primarily for improving navigation are to be exempt from taxation.

Municipally owned dams and power plants for irrigation or for supplying power for municipal purposes are to be given preference in making leases for surplus water-powers in the streams. The bill does not apply to water-power on small streams and creeks used for gristmills, sawmills, etc.

The measure contains a drastic anti-monopoly clause providing that no dams or works constructed under its provisions shall be owned, leased, controlled or operated "by any device or in any manner so that they form part of or in any way effect any combination in the form of an unlawful monopoly, or form the subject of any unlawful constraint or conspiracy to limit the output of electrical energy or in restraint of trade."

Although the war talk has prevented it from attracting any considerable public attention, the Shields bill has for several weeks been the subject of one of the most interesting debates on conservation of natural resources that have ever been held in the Senate. With the passage of this measure, the Senate will at once take up consideration of the Ferris bill for the leasing of power sites in the public domain, which passed the House last year and again this year almost without opposition. A number of Senate amendments to the Ferris bill which have been approved by the Senate Committee on public lands, with the indorsement of Secretary of the Interior Franklin K. Lane, make its general policy along the same lines as that of the Shields bill.

## Municipal Lighting Association Supports Differential Rates

W. H. Lyons, president of the Massachusetts Municipal Lighting Association, appeared last week before the committee on public lighting of the Massachusetts Legislature in support of differential rates. The committee was hearing a resolve requiring the Gas and Electric Light Commission to investigate and readjust prices charged by central stations for electrical service, and the use of differential rates had been attacked. James A. Price of Boston, Mass., had criticised the use

of a 10-cent rate and a 2-cent rate in the same building. Mr. Lyons explained to the committee that the lower rate applied only to heating service, including electric-range and other applications, and said that by such discounts mortgages are kept off electric-lighting plants and the cost of lighting reduced at the consumer's premises. The municipal association opposed a bill prohibiting public-service corporations from selling electricity at less than 5 per cent above the cost of production and distribution.

## Outputs of Large Generating Systems

**Approximately 70 per Cent of the Central-Station Energy of the Country Generated by Thirty-six Companies, Chiefly in Hydroelectric Stations**

The accompanying table gives statistics for 1915 on the outputs, peak load and load-factor of the largest generating systems of the country. The combined outputs of these companies in the United States approximate 13,000,000,000 kw.-hr., of which in round numbers two-thirds was generated from water-power. Similar material for the year 1914 was published in the ELECTRICAL WORLD of March 27, 1915.

It will be noted from the tabulation that there is a slight falling off in the outputs of some of the Western companies over 1914, due, no doubt, to the depression incident to the European war. The tremendous output of the Commonwealth Edison Company is of note and shows an increase over the previous year of 7.6 per cent. The falling off in load-factor for 1915 compared with 1914 is probably the result of a very small increase in business the first eight or nine months of the year and then a sudden improvement in business the last few months of the year, thus increasing the maximum without a corresponding effect on the year's output.

Although the Niagara Falls Power Company shows an improved load-factor over the previous year, there is a loss in the yearly output. The figures given for the Ontario Power Company show the kilowatt-hours generated by that company during the year. In addition, the company also supplied to its customers from energy purchased 126,608,400 kw.-hr. Because of this condition the company will proceed at once with the construction of a third conduit and the installation of sufficient additional generating units to meet the increased demands upon its system. The company's power station is on the Canadian side of the Niagara frontier and it distributes a large block of energy to the Hydro-Electric Power Commission of Ontario, which in turn sells it at cost to the municipalities of the Province.

The Hydraulic Power Company of Niagara Falls, N. Y., still manages to show a yearly load factor of 91 per cent, although, like the Niagara Falls Power Company, it had a somewhat smaller yearly output of kilowatt-hours. The great bulk of this energy is used in the electrochemical industries at Niagara Falls, the chief of which is the Aluminum Company of America.

OUTPUT OF LARGEST GENERATING SYSTEMS

| System | 1915 | | | | 1914 | | | |
|---|---|---|---|---|---|---|---|---|
| | Peak Load (Kw.) | Date of Peak Load | Yearly Output (Kw.-Hr.) | Yearly Load Factor (per Cent) | Peak Load (Kw.) | Date of Peak Load | Yearly Output (Kw.-Hr.) | Yearly Load Factor (per Cent) |
| Commonwealth Edison Company | 337,900 | Nov. 29 | 1,198,636,900 | 42.50 | 306,200 | Dec. 15 | 1,114,130,000 | 43.60 |
| Niagara Falls Power Company | 126,320 | Dec. 27 | 899,427,550 | 81.28 | 131,520 | Jan. 5 | 906,513,620 | 78.70 |
| Ontario Power Company of Niagara Falls | ..... | ..... | 757,713,600 | ..... | 130,500 | Sept. 23 | 781,664,400 | 68.40 |
| New York Edison Company and United Electric Light & Power Company | 239,416 | Dec. 6 | 740,873,162 | 35.30 | 229,787 | Dec. 23 | 719,193,535 | 35.70 |
| Pacific Gas & Electric Company | 139,540 | Dec. 1 | 725,715,620 | 59.40 | 124,000 | Oct. 29 | 658,298,000 | 60.60 |
| Hydraulic Power Company | 87,395 | Dec. 16 | 695,619,456 | 91.00 | 87,457 | Mar. 27 | 703,105,872 | 91.70 |
| Public Service Electric Company of New Jersey | 143,000 | Dec. 10 | 490,684,988 | 37.73 | 123,539 | Dec. 23 | 430,818,532 | ..... |
| Montana Power Company | 89,000 | Dec. 20 | 489,831,218 | 84.10 | 61,000 | July 21 | 402,663,369 | 75.00 |
| Shawinigan Water & Power Company | * | ..... | ..... | ..... | 85,000 | July 7 | 430,000,000 | 58.00 |
| Detroit Edison Company | 101,800 | Dec. 17 | 393,129,850 | 44.10 | 83,300 | Dec. 15 | 313,718,600 | 43.00 |
| Mississippi River Power Company | 77,300 | Nov. 18 | 370,330,660 | 54.60 | 73,700 | Nov. 16 | 356,578,000 | 55.60 |
| Toronto Power Company | 102,000 | Dec. 29 | 348,000,000 | 39.00 | 72,000 | Dec. 4 | 236,328,680 | 37.50 |
| Duquesne Light Company | 83,000 | Nov. 29 | 347,514,317 | 48.00 | 72,000 | Dec. 21 | 315,210,796 | 50.00 |
| Great Western Power Company | 62,100 | Nov. 15 | 337,264,400 | 62.00 | 56,300 | Dec. 9 | 315,000,000 | 64.00 |
| Pacific Light & Power Corporation | 76,150 | Oct. 28 | 316,098,189 | 47.39 | 70,565 | Sept. 17 | 292,545,094 | 47.37 |
| Electric Company of Missouri / Union Electric Light & Power Company | 76,303 | Nov. 29 | 308,759,186 | 42.60 | 52,528<br>51,072 | Nov. 18<br>Dec. 7 | 228,209,988<br>189,677,593 | 49.78<br>42.40 |
| Puget Sound Traction, Light & Power Company | 66,000 | Dec. 30 | 295,766,712 | 51.20 | 67,200 | Dec. 17 | 299,622,508 | 50.90 |
| Utah Power & Light Company | * | ..... | ..... | ..... | 47,048 | July 9 | 287,792,765 | 70.00 |
| Southern California Edison Company | 56,625 | July 13 | 286,985,095 | 57.80 | 53,835 | Dec. 24 | 288,549,552 | 61.10 |
| Pennsylvania Water & Power Company | 76,000 | Dec. 12 | 45,771,130 | 51.90 | 74,000 | Dec. 17 | 277,200,000 | 42.50 |
| Buffalo General Electric Company | 62,460 | ..... | 273,940,000 | ..... | 52,450 | ..... | ..... | ..... |
| Philadelphia Electric Company | * | ..... | ..... | ..... | 77,728 | Dec. 1 | 250,697,952 | 36.80 |
| Consumers' Power Company | 65,930 | Dec. .. | 245,300,654 | 42.50 | ..... | ..... | ..... | ..... |
| Edison Electric Illuminating Company of Boston | 72,802 | Dec. 13 | 208,358,400 | 32.70 | 65,342 | Dec. 21 | 194,137,400 | 34.00 |
| Edison Electric Illuminating Company of Brooklyn | 62,000 | Dec. 23 | 188,516,851 | 34.70 | 49,300 | Dec. 9 | 153,946,900 | 35.60 |
| Portland Railway, Light & Power Company | 47,150 | Dec. 30 | 186,372,553 | 45.10 | 44,315 | Jan. 2 | 184,766,149 | 47.70 |
| Georgia Railway & Power Company | 77,100 | Dec. 17 | 179,976,596 | 26.65 | 44,320 | Oct. 28 | 145,684,800 | 37.50 |
| The New England Power Company | 49,300 | Dec. 29 | 172,863,764 | 40.05 | 35,000 | Dec. 15 | 120,000,000 | 39.00 |
| Washington Water Power Company | 28,691 | Jan. 20 | 165,913,500 | 66.00 | 29,641 | Dec. 29 | 169,691,800 | 65.40 |
| The Wisconsin Edison Company | 52,458 | Nov. 19 | 158,089,543 | 35.00 | 44,124 | Dec. 22 | 159,665,804 | 36.20 |
| Sierra & San Francisco Power Company | 40,560 | Feb. 26 | 190,147,804 | 53.50 | 40,080 | Jan. 6 | 179,444,960 | 51.20 |
| Great Northern Power Company | 32,000 | Nov. 23 | 142,249,020 | 50.80 | 30,400 | Nov. 13 | 136,733,810 | 52.00 |
| Minneapolis General Electric Company | 33,100 | Dec. 6 | 128,941,588 | 44.50 | 27,955 | Dec. 7 | 110,346,460 | 45.06 |
| Adirondack Electric Power Corporation | 38,400 | Dec. 13 & 29 | 128,640,000 | 38.20 | ..... | ..... | ..... | ..... |
| Alabama Power Company | 28,750 | Dec. 21 | 123,882,040 | 48.00 | 23,500 | Dec. 22 | 55,837,740 | 27.10 |
| Rochester Railway & Light Company | 37,000 | Dec. 15 | 123,401,451 | 38.00 | 28,500 | Dec. 16 | 123,850,785 | 49.60 |
| Southern Sierras Power Company / Nevada-California Power Company | 20,300 | July 28 | 114,187,385 | 64.20 | ..... | ..... | ..... | ..... |
| Potomac Electric Power Company | 36,200 | Nov. 30 | 111,082,725 | 35.03 | ..... | ..... | ..... | ..... |
| Toledo Railways & Light Company | 33,373 | Dec. 31 | 100,168,375 | ..... | 24,500 | ..... | 91,479,892 | ..... |
| Southwestern Power & Light Company | 16,600 | Dec. 22 | 87,089,000 | 44.00 | ..... | ..... | ..... | ..... |
| Southern Power Company* | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |

*No data received.

The returns of the Montana Power Company for the year indicate the average monthly load-factor on the system. On account of the large increase in business during the last three months of 1915, which included the load of the Chicago, Milwaukee & St. Paul Railway Company and that for electrolytic smelting, the company does not consider it fair to figure the yearly load-factor as the ratio between the peak and the average. Practically all of the energy used in the State of Montana is manufactured by the Montana Power Company.

The Detroit Edison Company makes an excellent showing. There is no change in the make-up of the load reported. As usual, the dominating characteristic is industrial power. The figures exclude the output of the outlying power houses, and the combined figures for the Detroit and interconnected eastern Michigan territory show a total output of 409,526,910 kw.-hr.

The Mississippi River Power Company, as is well known, supplies wholesale energy to various public utilities in Iowa, Illinois and Missouri. Except for the poor business conditions which obtained in the company's territory during a large part of the year 1915, a much larger increase would have resulted.

The Southern California Edison Company of Los Angeles did not succeed in disposing of so large an output in 1915 as it did the previous year. While energy was put to much the same use, the proportion of it used for power purposes in relation to the total output was not so great. It is safe to assume that the condemnation proceeding in reference to the company's property in the city of Los Angeles has somewhat hampered the company's business.

We present for the first time statistics for the Consumers' Power Company of Jackson, Mich. The power houses of this company and the cities and towns it supplies are all connected by about 800 miles of high-voltage transmission lines, and all of the different steam and hydroelectric stations are operated in parallel on the system. The company supplies energy for about 550 miles of interurban railways, also for city railway systems in all of the principal cities, and has in addition a large factory load. Energy is supplied to more than fifty municipalities in the State of Michigan.

With reference to the returns for the Georgia Railway & Power Company, it will be noted that the load-factor in 1914 was much higher than for the year 1915. This is due to the fact that one of the company's chief customers called on it for a large amount of energy which increased the maximum demand materially, but, inasmuch as the energy was only used intermittently and not continuously throughout the year, it resulted in decreasing the load-factor to the extent shown.

While the Inland Empire was not fortunate so far as general business conditions went during 1915, the Washington Water Power Company, which serves that district, expects some increase in the mining load due to the activity in the mining district caused by the higher prices of metals. Any advances in electrometallurgy or electrochemistry may contribute to further increases. A slight increase in the demands of farmers for irrigation work and for light and power in the city of Spokane is also looked for.

Of more than passing interest is the showing made by the Great Northern Power Company of Duluth, Minn. Approximately one-half of the total station output of this company is used by one electrochemical manufacturing concern, and of the remaining half about 22 per cent is used for unloading coal from boats, 32 per cent for city lighting, 20 per cent for street railways, 6 per cent for city pumping, and the rest by miscellaneous power users. During the year just past, however, the company has signed contracts for more new business in number of contracts and amount of earnings estimated than in any two years since the company has been in operation, and the expectation is that the output during 1916 will increase from 15 per cent to 20 per cent over the showing made for 1915, with nearly a proportionate increase in earnings.

Data are given for the Nevada California Power Company and the Southern Sierras Power Company, inasmuch as both of these companies are controlled by the same holding company and are really one company so far as operations are concerned.

As will be noted, the systems are fairly well scattered throughout the country. They are arranged in the order of their output, and every effort has been made to include every company having a yearly output of 100,000,000 kw.-hr.

---

## "America's Electrical Week"

**Plans of Society for Electrical Development for Great Electrical Celebration During First Week in December**

"America's Electrical Week" has been selected by the campaign executive committee of the Society for Electrical Development, Inc., as the official name for the great electrical celebration, Dec. 2 to 9. A start has already been made on the nation-wide campaign, which from every indication will surpass even the results accomplished by the 1915 "Electrical Prosperity Week."

The name "America's Electrical Week" was chosen this year because of its timeliness, the patriotic thought it conveys, the national aspect the name indicates, its euphony, and its appeal to every citizen. The date is practically the same as that of last year, which was generally conceded to be the best time of the year as it began the Christmas drive for big business.

The compaign executive committee, of which Gerard Swope is chairman, consists of the following gentlemen:

*Representing Jobbers*—Gerard Swope, vice-president Western Electric Company; Frank S. Price, Pettingell-Andrews Company, Boston.

*Representing Central Stations*—Charles L. Edgar, president Edison Electric Illuminating Company, Boston; Joseph B. McCall, president Philadelphia Electric Company.

*Representing Manufacturers*—Guy E. Tripp, chairman of the board, Westinghouse Electric & Manufacturing Company; Anson W. Burchard, vice-president General Electric Company.

*Representing Contractors*—James R. Strong, president Tucker Electric Construction Company, New York; George Weiderman, George Weiderman Company.

*Representatives-at-Large*—James H. McGraw, president McGraw Publishing Company; Thomas A. Wynne, Indianapolis, Jupiter Jovian Order.

*Ex Officio*—J. M. Wakeman.

The executive committee has selected the following representative men to serve as an advisory committee: W. H. Atkins, Boston; E. A. Edkins, Chicago; H. K. Mohr, Philadelphia; George Williams, New York; F. H. Gale, Schenectady; A. K. Baylor, New York; J. C. McQuiston, Pittsburgh; A. A. Brown, New York; N. H. Boynton, Cleveland; J. E. Livor, Boston; E. W. Rockafellow, New York; P. L. Thomson, New York; T. J. McManis, Harrison, N. J.; T. G. Whaling, New York; J. R. Strong, New York; J. R. Galloway, Washington; George Weiderman, Brooklyn; T. A. Wynne, Indianapolis; F. M. Feiker, New York; A. A. Gray, Chicago; F. B. Rae, Jr., New York; E. E. Whitehorne, New York; H. W. Alexander, New York; J. T. Kelly, New York; Hill Griffith, New York; A. J. Edgell, New York; J. M. Wakeman, chairman.

## Michigan Agricultural College Engineering Building Burns

An early morning fire on March 5 completely destroyed the new engineering building and shop buildings of the Michigan Agricultural College at East Lansing, with a loss of about $250,000. Practically all the engineering, shop and physics equipment was lost,

BURNING OF MICHIGAN AGRICULTURAL COLLEGE ENGINEERING BUILDING

including some of the finest civil-engineering equipment in the Middle West. All of the engineering students' laboratory reports, drawings, instruments and design drawings were destroyed, but arrangements were quickly made to continue classes in various buildings and complete the year despite the serious handicap. The college gives a course in electrical engineering.

## Jovian Order to Promote Vulcan Degree to Strengthen Finances

Although the annual dues to the Jovian Order are $2 per member, figures compiled by the organization's central office from an average of the last four years show that the expenses per member are $3.58. In other words, were the annual dues the only source of income there would annually be a deficit of $1.58 per member. For the present, it is pointed out in the March issue of the *Jovian*, the official organ of the order, there are three other sources of revenue—one-half of initiation fees, advertising in the *Jovian*, and the dues from the one hundred and odd members of the experimental organization, the Vulcan degree.

Initiation fees, it is pointed out, cannot continue indefinitely, and, moreover, afford an unsound system of financing. Proceeds from advertising in the official organ, it is felt, should not be allowed to more than meet the expenses of that publication and, in case they should do so, ought to be expended in bettering the publication. Since membership fees have proved inadequate at the present rate, and since no permanent relief can be sought either from initiation fees or from fees for advertising in the *Jovian*, it is suggested that the order turn to the only other available source of revenue, namely, the Vulcan degree.

The Vulcan degree, in fact, is an agreement by those members of the national body who can do so without embarrassment to pay an amount of $10 per year as an investment in what might be termed the constructive development work that has been and is to be accomplished by Jovianism. The order acknowledges this payment by special credentials and the use of a capital letter "V" after a member's potential.

It was the intention to make of the Vulcan degree a group of big-minded co-operators representing the highest type of men in the electrical industry, or, as the *Jovian* states, "men who have 'arrived,' so to speak, and are willing to pay a trifle more than the fellow 'on the way' in order that with practical, commercially valuable work the order may secure itself in the electrical industry." It is asserted in support of this by those who are believers in the Vulcan degree plan that raising the regular dues of the national body would force out thousands of young men who cannot afford to pay more at their present stage of development but who are desirable members nevertheless and have a high value as field workers.

The Vulcan degree was placed in operation last March, a hundred and odd members were obtained, and a period of observation was established to ascertain the faults, if any, in the plan. That period has expired, and the Vulcan degree will shortly be offered to all those members who it is believed should accept it.

## Los Angeles Files Condemnation-Proceeding Brief

Attorneys for the city of Los Angeles on Feb. 26 filed with the Railroad Commission a statement reviewing the issues raised during the condemnation proceedings against the Southern California Edison Company and urging the commission to fix a value of not more than $3,887,838 on that part of the distributing system which the city seeks to acquire.

The document, which includes 130 pages of printed matter and various charts, asks that conclusions be reached as follows: First, that the present worth of the property to be taken, with the business attached, as a going concern, does not exceed the amount fixed by the witnesses for the city, to wit, $3,473,803.11; second, that damage to remaining property, or severance damage, is limited to rendering temporarily idle a portion of the generating and transmission equipment of the company's system, and the maximum amount that should be allowed for such severance damage is the sum of $414,035.58; third, that the total just compensation to be paid the company by the city upon the condemnation of the property to be taken should not exceed $3,887,838.69.

## How Design of Power-Station Buildings Affects Financing

"I believe that money spent in placing a certain amount of adornment on a power-station building will prove a good investment," said James N. Hatch, consulting engineer, Chicago, in a paper presented before the Western Society of Engineers on March 6. "I would not advise that a power house be made to look like a Carnegie library, but neither would I recommend that it be made absolutely plain and that no attention be given to its external appearance. For the ease with which securities for electric central-station projects can be floated often depends to a large extent upon the impression the head of some bond house receives from a company's existing power-house structures or from the drawings of structures under consideration. The cost of making any proposed power house sightly is slight, amounting in most cases to less than 0.5 per cent of the station investment. I reiterate, therefore, that this small additional investment may be made with wisdom."

In discussing the paper, J. L. Hecht, mechanical engineer for the Public Service Company of Illinois,

concurred with Mr. Hatch in his opinion, and pointed out the additional fact that a few dollars spent in meeting insurance company's requirements in building construction may save large sums in annual insurance premiums. L. H. Keller of the Commonwealth Edison Company said he had observed from European technical literature that the tendency was away from the present very tall power-house building with its high natural-draft stacks, and toward a lower and more flat design. In some instances, he said, the adoption of lower building designs had made possible a saving of 80 per cent in the amount of structural steel needed. The different European building designs are made possible, he concluded, by the use of boilers with built-in economizers and the use of forced draft.

## Will Operating Economies Continue to Offset Higher Costs?

As is now well known, the price of generating and distributing equipment for central-station service has increased considerably of late—so much so that many engineers have begun to ask whether a revision of rates would not be in order. The actual conditions confronting the industry are well set forth by Alex Dow, president of the Detroit Edison Company, who in his annual report has anticipated somewhat the thoughts which might occur to the stockholders. He says:

"It may be well to offer answers here to two questions likely to be asked by stockholders. First, the continued reduction of the ratio of operating expenses to gross earnings is due, as in 1914, to improved operating methods. It is in no part due to reduction of staff, or of wage rate, or of maintenance expenditures. On the contrary, the wage rate has increased, and expenditures for maintenance have been according to our established rule. It is well to say, nevertheless, that certain conditions in 1914, continued into 1915, have favored comparisons with preceding years. We may now look for higher prices for coal and for metals, and the wage standard, always high in Detroit, is not likely to be lower. The improved production methods which became effective in our power houses in 1914 have brought us nearly to the limit of economy possible with the present equipment. Our selling prices, especially for power, have always been comparatively low, and the class of our business which is now having the greatest growth —namely, industrial power for large factories—is essentially a class in which the ratio of operating expense to gross earnings is high, although the ratio of investment to gross earnings is comparatively low.

"The second question anticipated is as to what effect war orders, so called, have had on the earnings of the company and, particularly, what effect completion or stoppage of such orders may have in 1916 or a later year. Our answer, after careful inquiry, is that we cannot designate so much as 3 per cent of our power sales in 1915 as having been used directly in filling war orders. But, unquestionably, many factories served by us and now full of orders for home markets will at the end of the war period meet keener competition in these markets because of the release of manufacturing capacity elsewhere than in Detroit.

"On the other hand, we can point to customers of ours who had an established business in markets now closed and who may reasonably expect to resume their sales in these markets when peace comes. We are frankly unwilling to predict industrial conditions for the United States at large after the passing of the European troubles, but we think that for Detroit and its vicinity possibilities of gain are more than those of loss."

## Experts Differ Widely on Philadelphia Electric Plant-Renewal Costs

Wide differences have been revealed in the claimed reproduction value of the physical properties of the Philadelphia Electric Company submitted to the Pennsylvania Public Service Commission in the suit instituted by the city of Philadelphia against the company in an effort to obtain reduced rates for lighting and motor service.

After an exhaustive appraisal conducted by Prof. D. C. Jackson of Boston, the company recently submitted figures in which it put its replacement value at $51,562,000. Henry W. Ballard of Cleveland, expert for the complainants, contends that the plant could be replaced for $28,583,000.

Following is an interesting table showing the differences, item by item, between the valuations affixed by the two experts:

| | Jackson | Ballard |
|---|---|---|
| Overhead lines | $4,017,000 | $3,468,000 |
| Lamps, etc. | 512,000 | 494,000 |
| Underground lines | 6,248,000 | 5,515,000 |
| Land | 2,356,000 | 1,580,000 |
| Buildings | 2,868,000 | 2,370,000 |
| Meters, etc. | 1,669,000 | Same |
| Station equipment | 7,852,000 | 5,634,000 |
| Horses and vehicles | 2,303,000 | Same |
| Furniture, supplies, etc. | 1,225,000 | 451,000 |
| Commercial steam heat | 30,000 | 28,000 |
| Work in progress | 5,089,000 | 5,000,000 |
| Piecemeal construction | 3,500,000 | Included above |
| Working capital | 1,117,000 | 450,000 |
| General contractors' profit | 1,067,000 | Included above |
| Corporate organization, capital stock, bonds, taxes and administrative expenses | 2,201,000 | 1,722,000 |
| Brokerage | 1,998,000 | None |
| Patents | 1,609,000 | Nothing* |
| "Going concern" value | 5,000,000 | None |

*On claim that most of company's patents have expired.

Mr. Ballard's contention that the company's working capital could be reduced from $1,117,000 to $450,000 provoked much comment. According to his calculations, the company's outstanding securities need not be more than $25,000,000 instead of $50,000,000 as at present.

Mr. Ballard also made the statement that the surplus earnings of the Philadelphia Electric Company should make possible reductions in rates approximately as follows:

| | Present Rates per Kw.-Hr., Cents | Proposed Rates per Kw.-Hr., Cents |
|---|---|---|
| Municipal arc lighting | 4.20 | 3.40 |
| Commercial arc lighting | 6.50 | 6.50 |
| Commercial power | 3.70 | 3.70 |
| Railway and utilities | 0.96 | 0.96 |
| Commercial lighting | 6.70 | 3.40 |
| Residence lighting | 9.70 | 4.90 |
| Average rates | 3.64 | 2.66 |

## Massachusetts Commission Condemns Sliding Scale at Boston

In an exhaustive report to the Legislature the Massachusetts Gas and Electric Light Commission recommends the abolition of the sliding-scale act, under which the price of gas is fixed for customers of the Boston Consolidated Gas Company, unless the present control of the stock of this utility is taken from the Massachusetts gas companies. Chapter 422, Acts of 1906, established a standard price of 90 cents per 1000 cu. ft. and a standard dividend of 7 per cent, with the provision that for every decrease of 1 cent in price the company might increase its dividend 0.2 per cent. The present price is 80 cents. So far as the commission is aware, this is the sole instance in the United States in which

this particular system of regulation has been tried.

The board points out that the avowed purpose of the sliding-scale act is to increase the incentives to economical management by the prospect of a definite and assured increase in dividends, the public reaping the advantage in prices resulting from a decrease in operating costs. There has been a decrease in the net cost at the burner, but this is the case with companies not under the sliding scale and is attributed to a greatly increased output without any corresponding increase in actual expenses. Undoubtedly reductions in price have contributed to this result. Because of common ownership of the Boston and the New England gas and coke companies, there is no opportunity to exhibit even shrewdness in the making of a contract for the purchase of gas from the latter.

The commission states that it is a serious question whether the sliding scale offers in the long run any substantial advantage to the public or to the companies over the system of regulation so long pursued in the State. Its vogue in England is due in large measure to the fact that direct interference with gas prices is virtually unknown there, and that it is the alternative to the maximum-dividend method of control under which a company is permitted to earn the maximum dividend and no more. Because of the present desperate national stress the sliding-scale companies appear to be under distinctly adverse conditions as compared with the maximum-dividend companies. The trading relations with the affiliated companies forced upon the Boston company by their common ownership are inconsistent with the sliding scale as a scheme of regulation. It is of vital importance to the consumer that if his sole reliance for lower prices rests upon the incentives of the sliding scale, no profits on the gas which he consumes shall be distributed save through the dividends of the gas company.

## Electrical Exports for 1915

Electrical exports for the year 1915 were over $4,000,000 greater than during 1914, according to the report on December exports made by the Bureau of Foreign and Domestic Commerce. The total for 1915 was $24,308,510, as against $19,963,115 for 1914. While the increase over 1914 was appreciable, it is almost $4,000,000 less than the value of electrical goods exported in 1913.

The export trade for 1915 was particularly poor in dynamos and generators, motors, telephones and transformers. The exports of telephones have been falling off now for some time. They were $400,000 less in 1914 than in 1913, and in 1915 they made a further decrease of over $300,000. The 1914 demand for generators was, with the exception of about $2,000, practically the same as for 1913, while the 1915 exports were $500,000 less than those for 1914. American motors also have been in less demand abroad for some time. The 1914 exports were over $1,500,000 less than for 1913, and the 1915 exports showed a further drop of $20,000. The transformer trade, which picked up in 1914 to the extent of over $60,000, fell back in 1915 by considerably more than $200,000.

On the other hand, the values of the exports increased perceptibly in batteries, insulated wire and cable, interior-wiring supplies and metal-filament lamps. On certain of these goods, particularly insulated wire and cable, a large part of the increased value of the 1915 exports may be accounted for by an increase in the price of the goods. Under these conditions it would be difficult to determine to what extent there had been an increase, if any, in the export of electrical goods manufactured in the United States. At the same time, there has been appreciable increase in the prices of most of the goods that were exported in less value in 1915, indicating, perhaps, a worse condition than would be apparent merely from the government's figures.

In the matter of lamps, however, it is known that the quantity of metal-filament lamps exported in 1915 was between four and five times that exported in 1914, and practically five times the exports in 1913. The exports of carbon-filament lamps, while some two-thirds those of 1913 in quantity, were over double those of 1914. Arc lamps have been decreasing each year, until in 1915 they were less than one-sixth what they were in 1913 and but a little more than half what they were in 1914.

ELECTRICAL EXPORTS FOR DECEMBER AND FOR CALENDAR YEAR

| Articles | December | | Calendar Year | |
|---|---|---|---|---|
| | 1915 | 1914 | 1915 | 1914 |
| Batteries | $110,164 | $58,947 | $1,364,999 | $635,522 |
| Dynamos or generators | 116,383 | 262,325 | 1,872,191 | 2,372,816 |
| Fans | 20,308 | 13,784 | 374,113 | 295,966 |
| Insulated wire and cables | 174,886 | 92,146 | 2,761,609 | 1,321,451 |
| Interior wiring supplies, etc., including fixtures | 76,967 | 54,836 | 882,981 | 591,136 |
| Arc lamps | 3,392 | 742 | 23,968 | 42,782 |
| Carbon - filament lamps | 23,945 | 3,962 | 150,111 | 88,025 |
| Metal-filament lamps | 120,998 | 64,058 | 873,862 | 278,061 |
| Meters and other measuring instruments | 68,463 | 21,200 | 657,129 | *157,386 |
| Motors | 233,250 | 271,192 | 3,279,174 | 3,300,839 |
| Telegraph instruments (including wireless apparatus) | 14,201 | 2,118 | 136,890 | 93,563 |
| Telephones | 87,722 | 113,627 | 910,562 | 1,251,788 |
| Transformers | 50,477 | 62,097 | 704,373 | 934,312 |
| All other | 1,076,182 | 599,529 | 10,316,548 | 8,599,468 |
| Totals | $2,177,338 | $1,620,563 | $24,308,510 | $19,963,115 |

*Figures cover period beginning July 1.

The official figures for the exports of electrical goods manufactured in the United States are shown herewith, the values only being given.

## Heating Buildings by Electricity

For the purpose of determining the desirability of heating office buildings by means of surplus power, the Washington Water Power Company of Spokane has been experimenting for the past three years. It has just announced that the plan is practicable, and the officers of the company are now considering the commercial aspects of the situation, including possible rates to be charged. Further investigations will be made covering other systems of electrical heating.

In a statement given out by C. S. MacCalla, general manager of the power company, the following interesting information is furnished:

"The Washington Water Power Company for the last three years has been successfully heating by electricity its own four-story office building, corner of Trent and Lincoln Streets, using a special steam boiler connected to the ordinary steam radiators originally installed for use on the standard coal-fired boilers. In the 'electric-steam' boiler the electricity is introduced into the boiler in so-called 'cartridge units.'

"This apparatus has been developed to the point where it is entirely feasible physically and is applicable for use in congested areas such as the down-town business district, where there is available a supply of

'waste' electric power. In the more sparsely settled districts the cost of distributing the electricity makes the problem a more difficult one from the commercial standpoint.

"The company now proposes to heat its large substation building on Post Street by using the existing heating plant, merely substituting electric heaters in the firebox of the steam boiler in place of the ordinary coal or wood fuel.

"The chimney or flue will be closed and a fan used to circulate the hot air through the tubes of the boiler. The advantage of this system is that all the present steam apparatus can be used, and, if desired, the plant can be changed in less than an hour from an electric to a coal-fired boiler. This feature is attractive where 'waste' electricity is used."

It is understood that should the company care to go into this business it would not have to seek a new franchise, as the present franchise is sufficiently broad to cover building heating by electricity. The company has withheld information regarding the experiments in order to avoid the flood of inquiries that would result. Considerable time will elapse before the company will be in a position to estimate the rates for the service.

## Interpretations of Indiana Utility Law

Thomas Davis, chairman of the Indiana Public Service Commission, speaking before the Jovian League of Minneapolis, discussed a subject of great weight and importance and particularly pertinent in Indiana at the present time, namely, the State regulation of utilities. He outlined the regulatory statutes of Indiana, and interpreted them in the light of experience, pointing out the commission's limitations, particularly with reference to the authorization of security issues. Mr. Duncan said:

"The statute imposes upon the commission the duty of authorizing the issue of stock and bonds and other evidence of indebtedness. But this duty imposed is hedged about by certain inflexible statutory limitations beyond which we cannot go. The statute does not make us the guardian of either the public-service corporations or the investors in their securities. The law simply empowers us to hear the evidence and determine the facts, and if we find that the proposed issue complies with the law authority must be granted. The courts have compelled and will compel us to issue the authority. The courts have held such laws unconstitutional in every instance where a ministerial body has been given power to grant or refuse the authority in its discretion.

"The commission is authorized to grant authority for the issue of stock and bonds for three purposes: (1) for the acquisition of property or the enlargement of plant; (2) for the reimbursement of the treasury for money actually expended for capital account from income, and (3) for the discharge or lawful refunding of obligations.

"Stocks and bonds can only be issued for money or for labor or property at its true money value, as found and determined by the commission. Yet, when the statute has been complied with and bonds are lawfully issued for money or for property or labor at its true money value, such bonds often become a part of a great mass of pre-existing bonds for which the company receives little or no consideration. As a part of the total aggregate issue the bonds may or may not be good. But recently the Supreme Court of Indiana handed down its invincible mandate and directed us to issue bonds we thought ought not to be issued.

"Under this statute we have authorized the issue of more than $30,000,000 of securities, a part of which have been for refunding obligations. Here we have the least power. The only inquiry we can make is: 'Is the obligation to be refunded a lawful obligation?' If so, the courts will order us to issue the authority. If it is for the acquisition of property or the enlargement of plant, etc., or to reimburse the treasury for money expended to capital account, we have a different inquiry. We must find that the utility has received, or will receive, in property or labor the true worth of its money. The statute provides that bonds may be sold for 75 per cent of their face value.

"From the proceedings before the commission the investor can determine whether he should invest in such securities. Every authorized issue of bonds has increased the value of every pre-existing issue where such pre-existing issue was worth less than par. By this gradual increase in value of pre-existing securities the whole, in the course of years, will be leavened. Stock and bonds of the par value of millions have been issued in the past for little or no consideration.

"We do not intend here or elsewhere, in obedience to the demands from any source, to enter on any scheme of confiscation. We have refused to listen to unreasonable demands of the corporations. When the facts warranted a reduction of rates we have not hesitated to cut deep. Where the facts warranted an increase in rates we have been as free to grant that increase."

## Indianapolis Light & Heat Company to Build New Station

The Indianapolis (Ind.) Light & Heat Company is to erect a new central power station on the site of its station in Kentucky Avenue. The new station will cost approximately $4,000,000, including a two-hundred-and-fifty-thousand-dollar building. It will take several years to complete, according to officials of the company. Thomas A. Wynne, vice-president of the company, recently ordered the first part of the equipment, as announced last week. The company intends to begin the work as soon as delivery of machinery can be made. It is the announced intention of the company to build the new plant in sections and to erect a new building over the structure at present occupied before tearing down the old building, so that it will not be necessary to interrupt service. The new station is to be made one of the industrial show places of the Middle West, not only in size but also in appearance. The building, which is to be of brick, concrete and steel, is to cover a half block and will be about 100 ft. high and of ornamental design.

The first unit which the company is to set up will consist of an 18,000-kw. turbo-generator. Six of these turbines will be placed in the plant eventually. The order placed by Mr. Wynne also includes a condenser, stokers, a battery of boilers and a new coal-handling outfit. The boilers will operate at 250 lb. pressure and will have chain-grate stokers. Two 1500-kw. motor-generator sets also are in the equipment that will be placed in position this year.

The new stations will be larger than the Mill Street plant, which the company built some years ago. As at present, the Kentucky Avenue plant will be used chiefly to serve the users of light, power and heat on the company's lines in the central part of Indianapolis. The Mill Street plant is to continue in operation. The site for the new plant is convenient to railroad facilities for bringing coal from the Indiana coal fields. From the site, too, the company has a large pipe line extending to White River, whence water for all purposes is obtained. The company operates a steam-heating system in the down-town district.

# Performance of Diesel-Engine Plants in Texas

## Cost of Installation, Fuel and Lubricating-Oil Requirements, Engine Maintenance, Energy-Production Costs and Other Operating Data from Eight Stations

BY R. H. BURDICK

Member Engineering Staff Electric Bond & Share Company

EIGHT Diesel-engine installations in small electrical generating stations in the State of Texas are operated by the Texas Power & Light Company. Tests have been conducted at these plants and operating records kept which show results of performance and operating practice in modern plants of this type. In what follows data are presented in considerable detail giving performance for a recent installation at Paris, Tex., shown in Fig. 1.

The Paris installation consists of an initial equipment of three McIntosh & Seymour Diesel engines rated at 500 hp. each. These units are of the four-cylinder, four-stroke-cycle design operating at 164 r.p.m. and directly connected to three 437-kva., 2300-volt, three-phase, sixty-cycle alternators. Two 35-kw. induction motor-driven sets and one 35-kw. belt-driven exciter set are provided, the latter being driven from the generating unit. Compressors and water-circulating pumps are integral with engines. The apparatus is housed in a steel-frame plastered building 82 ft. 6 in. long by 52 ft. 6 in. wide and 33 ft. high to the eaves, with a flat concrete roof and concrete floor. The construction of this station with the cooling tower for the engines is shown in Fig. 6. Outside the station on a wooden-pole switch and bus structure are installed three 250-kva., 2400-volt to 24,000-volt, single-phase transformers and three 75-kva., 2200-volt to 6600-volt, single-phase transformers with air-break switches.

The station feeders at this plant are arranged to provide energy at 24,000-volt, three-phase alternating current for a transmission line; 6600-volt, three-phase alternating current; 2300-volt, three-phase alternating current regulated; 2300-volt, three-phase alternating current unregulated; 2300-volt, single-phase alternating current arc service, and 500-volt direct current railway service.

TABLE I—DIESEL-ENGINE STATIONS OPERATED BY TEXAS POWER & LIGHT COMPANY

| Location | Number of Units | Total Hp. |
|---|---|---|
| Paris | 3 of 500 hp. each | 1500 |
| Palestine | 1 of 500 hp. | 500 |
| Tyler | 4 of 225 hp. each | 900 |
| Taylor | 1 of 225 hp. | 225 |
| Brownwood | 3 of 225 hp. each | 675 |
| Gainesville | 3 of 225 hp. each | 675 |
| Sweetwater | 2 of 225 hp. each<br>1 of 170 hp. | 620 |
| Big Springs | 2 of 225 hp. each | 450 |
| Total | 20 averaging 277 hp. each | 5545 |

NOTE.—McIntosh & Seymour engines are used at Paris and Palestine, Busch-Sulzer in all other stations.

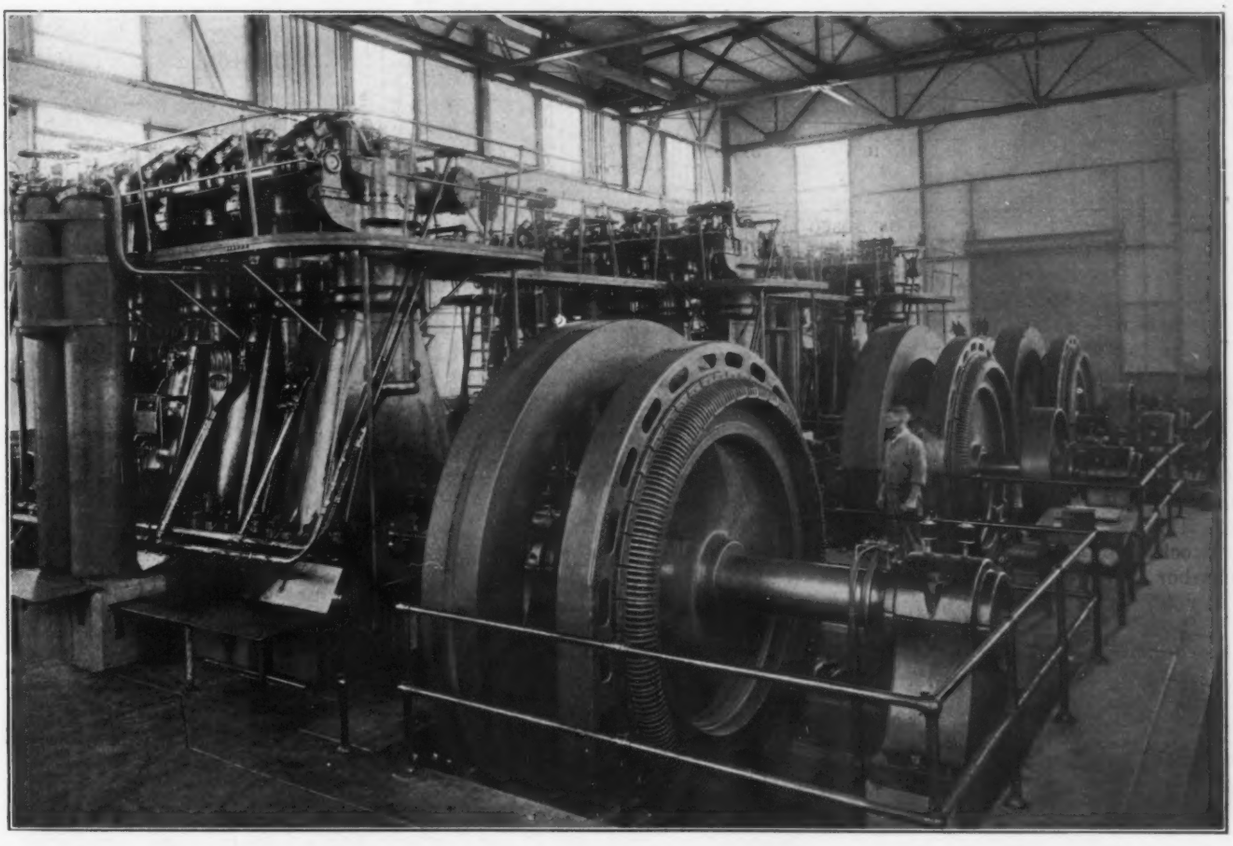


FIG. 1—THREE 437-KVA. GENERATORS DRIVEN BY 500-HP. DIESEL ENGINES IN PARIS (TEX.) STATION, TEXAS POWER & LIGHT COMPANY

An oil-storage tank of 360 barrels capacity and a cooling tower of the atmospheric type exposing 5100 sq. ft. of cooling surface are provided for the equipment.

The Diesel-engine installations operated in central stations controlled by the Texas Power & Light Company are given in Table I and have a total rating of 5545 hp. The chief reasons influencing the utilization of Diesel engines in preference to steam or other types of prime movers in these small isolated generating stations are summarized as follows: (1) Abundance of low-priced fuel oil; (2) efficiency of Diesel engines at low station factors; (3) comparatively low labor costs; (4) flexibility of plant, that is, the ability to meet unusual peak-load conditions without loss of time or operating economy; (5) absence of standby losses other than interest on investment when units are not in service; (6) ease of transfer of equipment from any isolated station which may be picked up by a transmission-line extension to another isolated station whose increase in load warrants the installation of additional equipment.

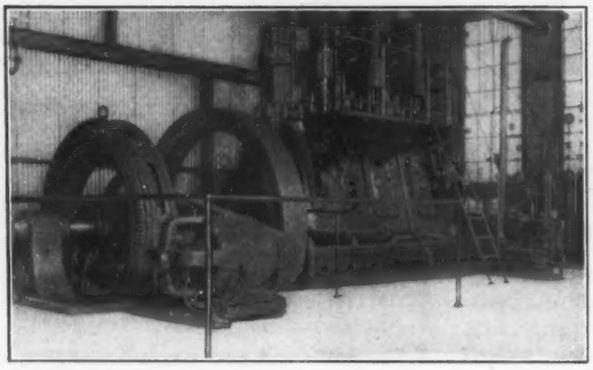


FIG. 2—DIESEL ENGINE UNIT IN BIG SPRINGS (TEX.) STATION

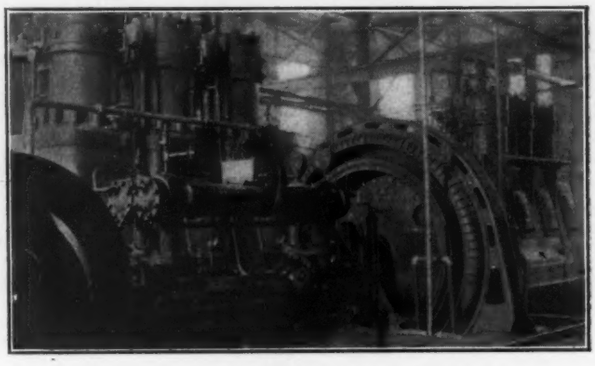


FIG. 3—INTERIOR OF STATION AT TYLER, TEX.

While it is practically impossible to lay down definite general rules for the selection of Diesel engines in preference to steam or other types of prime movers for small central stations, or to prescribe the limitations as to the size of plant where Diesel engines are applicable over and above other types of equipment, because of the many varying considerations entering into each problem, among which are character of load, availability of proper fuels and labor, investment allowances and the like, the following information and data drawn from tests and a performance of modern equipment are of engineering interest:

In Table II a summarized comparison of estimated construction and operating costs for a steam and Diesel installation at Paris, Tex., is given in order to show some of the reasons for the selection of the latter type of equipment for this station. Such a comparison, however, cannot be used as a criterion for other installations unless due consideration is given to the variable factors which have already been mentioned. The construction of the steam plant on which steam estimate in Table II is based contemplated the installation of one 350-kw. and one 750-kw., sixty-cycle, three-phase, 2300-volt turbo-alternator with requisite auxiliaries, in-

TABLE II—COMPARATIVE ESTIMATES FOR DIESEL AND STEAM EQUIPMENT FOR PARIS (TEX.) STATION

| | Estimated for Diesel Station* | | | | | | Estimated for Steam Station† | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Quantity | Unit Used | Unit Cost | Cost per Kw. | Per Cent of Total | Total | Quantity | Unit Used | Unit Cost | Cost per Kw. | Per Cent of Total | Total |
| Station building | 134,000 | Cu. ft. | $0.10 | $12.76 | 8.8 | $13,395 | 108,000 | Cu. ft. | $0.12 | $11.78 | 11.7 | $12,960 |
| Oil-engine equipment | 1,050 | Kw. | ..... | ..... | 45.3 | 69,485 | ..... | ..... | ..... | ..... | ..... | ..... |
| Boiler equipment | ..... | ..... | ..... | ..... | ..... | ..... | 900 | B.-hp. | $21.40 | 17.50 | 17.4 | 19,260 |
| Turbo-generator equipment | ..... | ..... | ..... | ..... | ..... | ..... | 1,100 | Kw. | $24.00 | 24.00 | 23.9 | 26,400 |
| Electrical equipment | 1,050 | Kw. | $27.30 | 27.30 | 18.7 | 28,620 | 1,100 | Kw. | $16.50 | 16.50 | 16.4 | 18,150 |
| Transformer yard | 1,275 | Kva. | $4.15 | 5.03 | 3.5 | 5,280 | 1,275 | Kva. | $4.15 | 4.80 | 4.8 | 5,280 |
| General station equipment | ..... | Job | ..... | 4.56 | 3.1 | 4,785 | ..... | Job | ..... | 5.20 | 5.2 | 5,720 |
| Improvements to grounds | ..... | Job | ..... | 0.29 | 0.2 | 300 | ..... | Job | ..... | 0.27 | 0.3 | 300 |
| Construction plant | $121,865 | % | 2.0 | 2.32 | 1.6 | 2,440 | $88,070 | % | 2 | 1.60 | 1.6 | 1,760 |
| Overhead expenses | $124,305 | % | 23.0 | 27.39 | 18.8 | 28,695 | $89,830 | % | 23 | 18.78 | 18.7 | 20,660 |
| Total cost | 1,050 | Kw. | $145.75 | | 100 | 153,000 | 1,100 | Kw. | $100.44 | | 100 | 110,490 |
| | 1,500 | E.-hp. | $102.00 | | | | 1,500 | E.-hp. | $73.70 | | | |

| | For Diesel Station | For Steam Station |
|---|---|---|
| Plant data: | | |
| Size of plant | 1,050 kw. | 1,100 kw. |
| Number of units | 3 | 2 |
| Yearly output station factor | 4,600 m. kw.-hr. | 4,600 m. kw.-hr. |
| Station factor | 50 per cent | 48 per cent |
| Fixed charges | 15 per cent = $22,950 | 12 per cent = $13,260 |
| Interest | 7 per cent | 7 per cent |
| Depreciation | 8 per cent | 5 per cent |
| Output costs: | Mills per Kw.-Hr. | Mills per Kw.-Hr. |
| Production cost | 4.66 | 8.56 |
| Fixed charges | 4.85 | 2.88 |
| Total station output cost | 9.51 | 11.44 |
| Estimated annual saving (Diesel over steam) | $8,880 | |

*Using oil at 3c per gal. †Using coal at $2.50 per ton.

cluding condensers, pumps and the like, and a boiler plant of three 300-b.-hp. water-tube boilers with individual steel stacks. The boilers were to be equipped to burn either crude oil or slack coal, and coal-handling apparatus was to be provided. The building required and considered was of the type given in the Diesel estimate, 80 ft. by 45 ft. by 30 ft. to eaves. The switchboard and substation equipment required was practically the same as shown in the Diesel estimate.

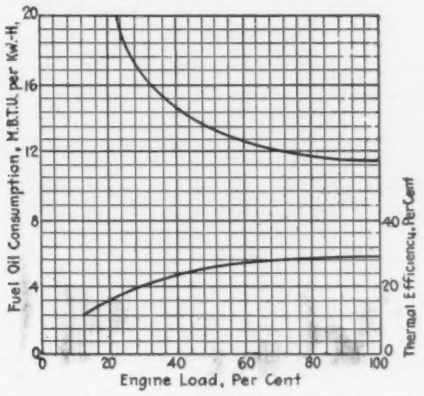



FIG. 4—AVERAGE FUEL CONSUMPTION PER KILOWATT-HOUR AND THERMAL EFFICIENCY OF PARIS (TEX.) DIESEL ENGINES

The approximate cost of another representative Diesel station erected by the Texas Power & Light Company in the latter part of 1914 at Tyler, Tex., is given in Table VI. This plant includes an initial installation of two second-hand Busch-Sulzer Diesel-engine sets built in 1907-1909, each consisting of two three-cylinder, four-stroke-cycle, 225-hp. engines directly connected to one 300-kw., 164 r.p.m. three-phase, sixty-cycle, 2300-volt generator. One 17-kw. induction motor-driven exciter set and one 20-kw. exciter belt-driven set operated from one of the engines were also provided. The necessary auxiliaries such as air compressors, water and oil pump, cooling tower and the like were included. The apparatus at this station is housed in a steel-frame plastered building 74 ft. 5 in. by 48 ft. by 21 ft. 6 in. to bottom truss and similar in construction to the Paris plant building. The feeder arrangement at this station provides service at 2200-volt, three-phase alternating current for power and lighting; 550-volt to 250-volt direct-current power, and 550-volt direct current for railway service. An oil-storage tank of 360 barrels capacity and a cooling tower of the atmospheric type containing 4700 sq. ft. of cooling surface are provided.

TABLE IV—ESTIMATED OBTAINABLE OPERATING RESULTS AND PRODUCTION COSTS IN DIESEL-ENGINE ELECTRIC STATIONS OF FROM 1000 KW. TO 2000 KW.

| | |
|---|---|
| DATA: | |
| Station factor, per cent | 50 |
| Fuel oil: | |
| B.t.u. per kw.-hr. output | 13,300 |
| Gallons per kw.-hr. output | 0.095 |
| Cost per gallon, cents | 3 |
| Labor: | |
| Man-days per m. kw.-hr. output | 0.46 |
| Cost per man-day | 2.80 |
| Lubricating oil: | |
| Gallons per kw.-hr. output | 0.0007 |
| Cost per gallon, cents | 30 |
| UNIT COSTS: | |
| Production costs (mills per kw.-hr.): | |
| All labor | 1.29 |
| Fuel oil | 2.85 |
| Water | 0.10 |
| Lubricants and waste | 0.21 |
| Miscellaneous supplies and expenses | 0.08 |
| Maintenance of engines | 0.10 |
| All other maintenance | 0.03 |
| Total | 4.66 |

TABLE V—ACTUAL UNIT PRODUCTION COSTS, PARIS AND TYLER DIESEL STATIONS, SEPT. 1 TO DEC. 31, 1915

| Article | Paris | Tyler |
|---|---|---|
| DATA: | | |
| Station output (m. kw.-hr.) | 1,565 | 499 |
| Rating of plant (kw.) | 1,050 | 600 |
| Station factor, per cent | 51 | 28½ |
| Total fuel oil (gal.) | 149,072 | 78,455 |
| Pounds oil per kw.-hr. output | 0.672 | 1.100 |
| B.t.u. per kw.-hr. output | 13,100 | 21,400 |
| Production costs (mills per kw.-hr.): | | |
| All labor | 1.44 | 2.24 |
| Fuel oil | 3.07 | 5.18 |
| Water | 0.09 | 0.19 |
| Lubricants and waste | 0.04 | 0.56 |
| Miscellaneous supplies and expense | 0.10 | 0.29 |
| Maintenance of engines | 0.04 | 4.48 |
| Maintenance of buildings | 0.05 | 0.05 |
| All other maintenance | 0.15 | 0.61 |
| Total production cost, mills | 4.98 | 13.60 |

TABLE III—SUMMARY OF TESTS ON PARIS (TEX.) DIESEL ENGINES†

| | UNIT NO. 1 | | | | UNIT NO. 2 | | | | UNIT NO. 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 3 | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Approximate load | Full | Three-fourths | Half | Quarter | Full | Three-fourths | Half | Quarter | Full | Three-fourths | Half | Quarter |
| Kw. (average) | 340.6 | 253.3 | 168.9 | 86.1 | 333.4 | 250.5 | 153.4 | 82.4 | 340.0 | 249.7 | 162.9 | 79.6 |
| Load-factor (kw.), per cent | 97.5 | 72.5 | 48.2 | 24.6 | 95.2 | 71.6 | 44.2 | 23.5 | 97.2 | 71.3 | 46.5 | 22.7 |
| Kva. (average) | 400.7 | 301.5 | 211.1 | 117.9 | 396.2 | 316.5 | 199.1 | 112.8 | 409.5 | 320.1 | 211.5 | 109.0 |
| Load-factor (kva.), per cent | 91.7 | 69.0 | 48.2 | 27.0 | 90.8 | 72.5 | 45.6 | 28.0 | 93.7 | 73.3 | 48.4 | 25.0 |
| B.-hp. (average) | 481.3 | 359.8 | 240.2 | 127.1 | 472.6 | 355.6 | 222.0 | 117.3 | 482.0 | 356.9 | 234·3 | 117.2 |
| Kw.-hr. generated (total) | 1299.3 | 891.1 | 577.0 | 101.9 | 1103 | 784 | 413.1 | 49.45 | 1008.5 | 919.7 | 450.9 | 55.7 |
| Time start, p.m. and a.m. | 2:29 | 7:13 | 2:53 | 11:37 | 6:00 | 2:21 | 10:01 | 1:16 | 5:55 | 2:02 | 9:41 | 12:54 |
| Time stop, p.m. and a.m. | 6:18 | 10:49 | 6:18 | 12:48 | 9:18½ | 5:28½ | 12:42½ | 1:52 | 8:53 | 5:43 | 12:27 | 1:36 |
| Duration of test, hours | 3.816 | 3.517 | 3.417 | 1.183 | 3.308 | 3.125 | 2.692 | 0.6 | 2.966 | 3.683 | 2.767 | 0.7 |
| Power-factor (average) | 0.85 | 0.84 | 0.80 | 0.73 | 0.84 | 0.79 | 0.77 | 0.73 | 0.84 | 0.78 | 0.77 | 0.73 |
| Kw. for excitation (average) | 8.1 | 6.91 | 7.64 | 7.42 | 7.25 | 7.90 | 6.50 | 7.17 | 7.4 | 7.0 | 7.1 | 7.3 |
| Fuel oil consumed (gal.) | 111 | 77 | 56 | 14 | 96 | 68 | 41.5 | 6.7 | 84 | 77½ | 44 | 7 |
| Fuel oil consumed (lb.) | 783 | 543 | 396 | 98½ | 673 | 481½ | 290½ | 47 | 592½ | 542½ | 310 | 49 |
| Fuel oil consumed (B.t.u.)* | 15,321,744 | 10,621,080 | 7,789,616 | 1,923,803 | 13,145,036 | 9,396,954 | 5,657,778 | 918,615 | 11,590,485 | 10,625,948 | 6,064,220 | 955,500 |
| Fuel oil per kw.-hr. (lb.) | 0.603 | 0.609 | 0.686 | 0.966 | 0.610 | 0.614 | 0.703 | 0.950 | 0.590 | 0.590 | 0.688 | 0.880 |
| B.t.u. per kw.-hr. | 11,792 | 11,930 | 13,500 | 18,879 | 11,917 | 11,984 | 13,720 | 18,576 | 11,492 | 11,553 | 13,448 | 17,154 |
| B.t.u. per b.-hp.-hr. | 8,342 | 8,396 | 9,491 | 12,795 | 8,407 | 8,450 | 9,467 | 13,052 | 8,037 | 8,083 | 9,354 | 11,646 |
| Generator efficiency, per cent | 92.6 | 91.8 | 89.5 | 83.0 | 92.5 | 91.4 | 88.7 | 86.0 | 92.6 | 91.3 | 89.2 | 82.8 |
| Thermal efficiency, per cent | 28.9 | 28.6 | 25.3 | 18.0 | 28.7 | 28.5 | 25.0 | 18.4 | 29.7 | 29.4 | 25.4 | 19.9 |
| Water for cooling (total gal.) | 14,653 | 11,606 | ** | 4,436 | 15,382 | 11,250 | 9,368 | ..... | 14,949 | 13,038 | 9,029 | ..... |
| Water per minute (gal.) | 64 | 55 | ..... | 62½ | 77.5 | 60.0 | 58 | ..... | 84 | 59 | 58 | ..... |
| Number units in operation | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 3 & 2 | ..... |
| Station load (average kw.) | 635 | 697 | 660 | 370 | 703 | 688 | 478 | 385 | 666.6 | 520 | 483 | ..... |
| Station factor (average) | 60.5 | 64.2 | 62.8 | 35.2 | 67 | 65.5 | 45.5 | 35.6 | 63.5 | 49.5 | 46.0 | ..... |

*B.t.u. per pound assumed as 19,500. **Not complete. †Tests conducted by author September, 1915.

## TESTS ON DIESEL-ENGINE EQUIPMENT AT THE PARIS STATION

The results of rigid tests conducted at the Paris plant are given in Tables III and V. This station is considered the most modern of those listed in Table I and is representative of present-day construction and arrangement for the efficient operation of Diesel-engine

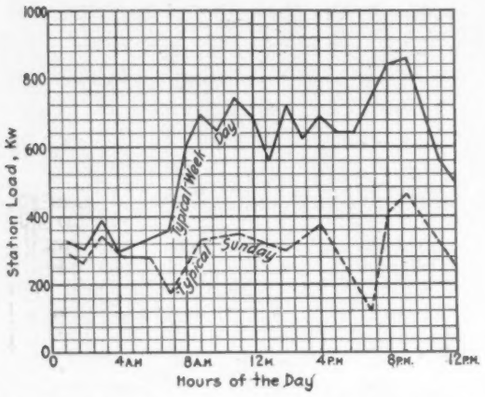



FIG. 5—TYPICAL HOURLY LOAD CURVES FOR PARIS (TEX.) STATION

installations. The apparatus tested consisted of three 437-kva. Diesel-engine-driven alternators already described. Four tests were conducted on each unit, varying in length from one hour to four hours, each machine in turn being subjected to full-load, three-quarters-load, half-load and quarter-load tests and these loads held as nearly constant as practicable. As the three generating sets were required for service almost continuously, it was not feasible at times to secure the test loads at exactly 100 per cent, 75 per cent, 50 per cent and 25 per cent of unit rating, but these loads were approximated and carried throughout each test with reasonable constancy.

The fuel oil used is given in Table VIII with a typical analysis. This fuel oil is known as "desulphurized" and is employed in practically all of the Diesel-engine stations operated by the Texas Power & Light Company. The fuel oil was pumped from an outdoor storage tank, weighed in a barrel on a platform scale and repumped therefrom to small individual engine-supply tanks. Accurate float-gage measurements of the supply tanks were taken, the error in such measurements being less than one-half of 1 per cent. All oil found leaking from injector-pump stuffing boxes or piping between small supply tanks and engines was caught in small receptacles, weighed, and credited to the performance of the engine during its test.

Sensitive thermometers were strapped to or inserted in all air piping and readings periodically taken during the tests. Temperatures of exhaust gases and samples

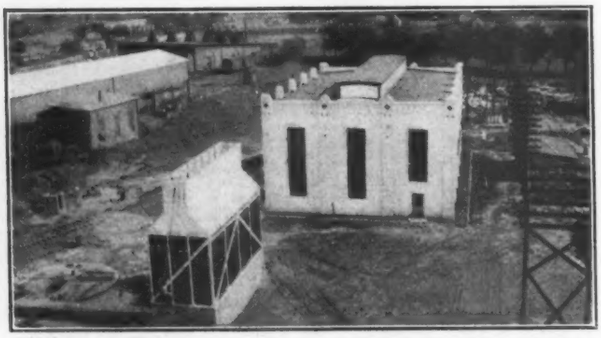


FIG. 6—PARIS (TEX.) STATION AND COOLING TOWER FOR ENGINES

TABLE VI—APPROXIMATE COST OF TYLER DIESEL STATION

| Article | Quantity | Unit | | Cost per Kw. | Per Cent of Total | Total |
|---|---|---|---|---|---|---|
| | | Used | Cost | | | |
| Station building | 100,000 | Cu. ft. | $0.111 | $18.50 | 12.6 | $11,146 |
| Engine and generator equipment | 900 | E.-hp. | 50.00 | 74.95 | 51.1 | 44,968 |
| Electrical equipment | 600 | Kw. | $13.90 | 13.90 | 9.5 | 8,340 |
| General station equipment | .... | Job | .... | 8.64 | 5.9 | 5,185 |
| Improvements to grounds | .... | Job | .... | 0.67 | 0.5 | 400 |
| Construction plant | $70,039 | % | 2 | 2.34 | 1.6 | 1,400 |
| Overhead expenses* | $71,439 | % | 23.2 | 27.60 | 18.8 | 16,561 |
| Total cost | 600<br>900 | Kw.<br>E.-hp. | $146.66<br>$97.78 | .... | 100 | $88,000 |

*Overhead expenses consist of the following cumulative percentages: (A) General expense, 5 per cent; (B) contingencies, 5 per cent; (C) engineering, 10 per cent; (D) interest during construction, 1.5 per cent.

TABLE VII—COMPARISON OF DIESEL-ENGINE PERFORMANCE WITH THAT OF OTHER PRIME MOVERS

| | Plant A (Paris, Tex.) | Plant B | Plant C | Plant D |
|---|---|---|---|---|
| Rating of plant | 1050 kw. | 13,000 kw. | 1050 kw. | 1055 kw. |
| Type of plant | Diesel | Steam turbine | Steam engine | Gas engine |
| Number of units | 3 | 3 | 3 | 4 |
| Fuel used | Oil | Oil and coal | Gas and coal | Gas |
| | B.T.U. PER KW.-HR. | | | |
| Average station factor, per cent: | | | | |
| 96.6 | 11,734 | ..... | ..... | ..... |
| 71.8 | 11,822 | ..... | ..... | ..... |
| 49.0 | .... | 27,000 | ..... | ..... |
| 46.3 | 13,556 | ..... | ..... | ..... |
| 34.0 | .... | ..... | ..... | 26,100 |
| 32.0 | .... | ..... | 43,200 | ..... |
| 23.6 | 18,203 | ..... | ..... | ..... |

TABLE VIII—TYPICAL ANALYSES OF FUEL OIL DURING PARIS (TEX.) DIESEL-ENGINE TESTS

| Sp. Gr. at 60 Deg. Fahr. | Baumé at 60 Deg. Fahr. | B.t.u. per Pound | Percentage Sulphur |
|---|---|---|---|
| 0.8463 | 35.7 | 19,545 | 0.34 |
| 0.8463 | 35.7 | 19,476 | 0.23 |
| 0.8468 | 35.6 | 19,516 | 0.17 |
| 0.8463 | 35.7 | 19,532 | 0.24 |
| 0.8463 | 35.7 | 19,587 | 0.32 |
| 0.8463 | 35.6 | 19,562 | 0.24 |
| 0.8464* | 35.66* | 19,536* | 0.256* |

*Averages.

TABLE IX—LUBRICATING-OIL COMPARISON AND SPECIFICATIONS

| | Oil Used in Paris Engines New | Oil Used in Paris Engines Filtered | General Specifications for Diesel-Engine Lubricating Oil (New) | |
|---|---|---|---|---|
| Boiling point, deg. Fahr | 650 | ..... | 590 | 700 |
| Flash point, deg. Fahr | 355 | 383 | 325 | 550 |
| Fire point, deg. Fahr | 430 | 473 | 400 | 600 |
| Viscosity at 100 deg. Fahr., Sayboldt | 750 | 532 | 600 | 800 |
| Specific gravity, deg. Fahr., Baumé | 19.5 | 20.2 | 18 | 24 |
| Carbon content, per cent | 0.05 | ..... | 0.05 | 0.3 |
| Sulphur content | None | ..... | ..... | ..... |

Strictly mineral oil absolutely neutral and free from animal or vegetable oils or adulterants such as gutta percha, soap compound, mica, graphite, steatite, wood pulp or soapstone.

thereof for analyses were taken from engine-exhaust headers between last cylinders and mufflers. The temperatures of cooling water were taken at numerous points to determine the absorption of heat by various portions of each engine, the rate and quantity of flow through each water-cooling part being determined by timing a given quantity into a barrel on a platform scale.

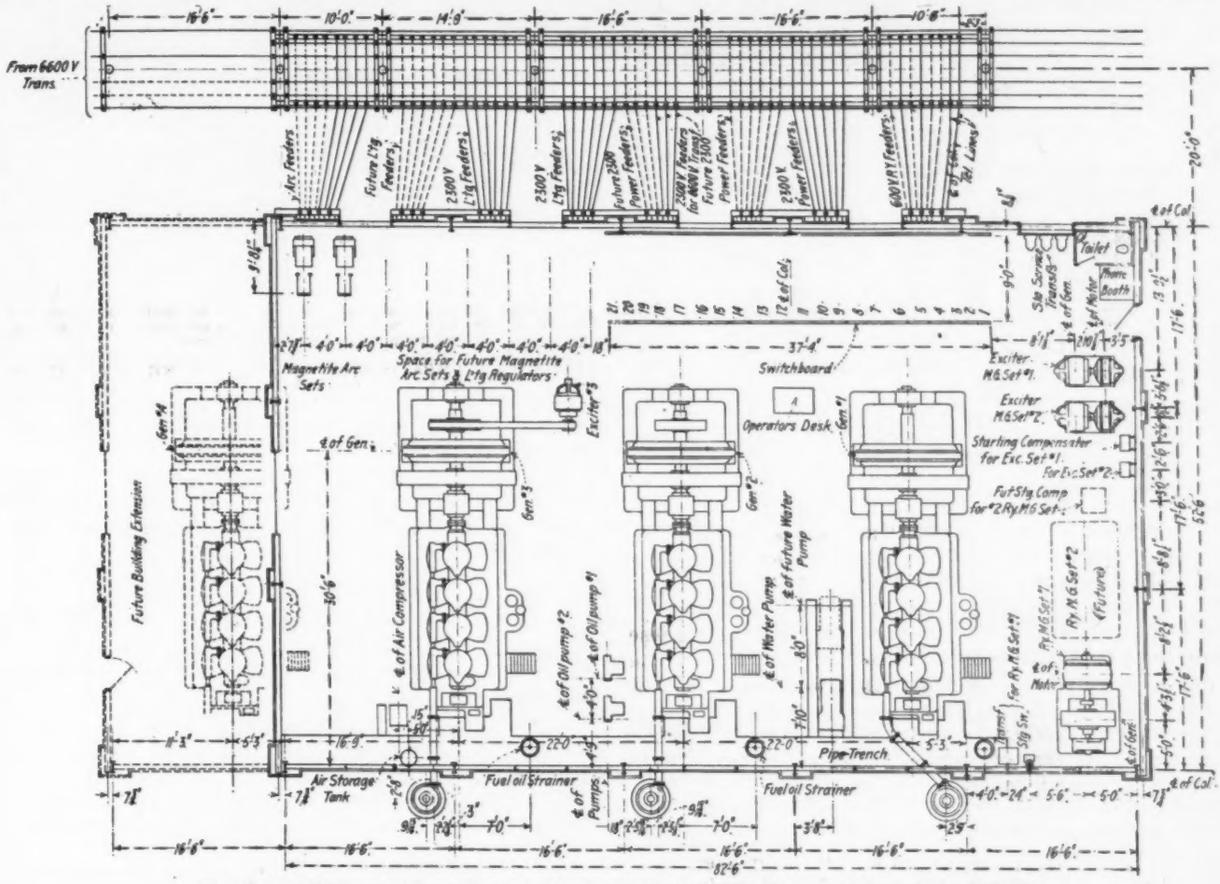



FIG. 7—LAYOUT OF EQUIPMENT IN PARIS (TEX.) STATION, SHOWING OUTGOING FEEDERS

Electrical data were secured from regular switchboard instruments, together with a special recording wattmeter for individual unit service. Certain general observations such as r.p.m., temperature of generator stator coils and the like were made and recorded. All instruments and test apparatus were checked before and after tests and corrections made in observed results when necessary. Summaries of the four tests on each unit are given in Table III.

The curve of average fuel consumption for the tests as shown in Fig. 4 is given in "gross B.t.u. per kilowatt-hours generated." In using the term "gross B.t.u." reference is made to the possible allowance for any unavailable latent heat carried off as uncondensed water vapor in exhaust gases (representing the products of combustion of hydrogen and oxygen) for which no allowance has been made. It includes any such latent heat which may have existed for the reason that in analyzing fuel oils the usual type of calorimeter was used, in which such latent heat is surrendered and included in the results of analysis. The lower curve of Fig. 4 shows the curve referred to and shown above converted into thermal efficiency, in the determination of which allowance has been made for electric-generator efficiencies. It actually represents the power delivered to the generator coupling in proportion to power supplied to the engine as fuel oil.

One of the chief faults with the guarantees made by Diesel-engine manufacturers and operators seems to be the tendency toward narrow specifications for fuel oils. Practically any crude or semi-refined oil having less than 1½ per cent sulphur content, 2 per cent water and 30 per cent asphalt may be safely used in Diesel engines if filtered. This statement is qualified to the extent of setting the fluidity at a free-flowing and free-pumping point. Usually oils having a specific gravity below 16 deg. to 17 deg. Baumé, as below, require heating to aid their feeding to the engine pumps properly.

With the exception of the Diesel engines at Paris and Palestine, the splash or crank-case system of lubrication is employed with indifferent success. In some instances oil alone is used in the crank case, and in other cases the lubricating oil is floated on water. Neither system can be considered particularly efficient or satisfactory compared with the forced-feed lubrication used on the more modern engines at Paris and Palestine. At the Paris installation the oil used for engine lubrication shows an analysis as given in Table IX. This oil is used new for cylinders and wrist-pin bearings and

FIG. 8—A 450-HP. DIESEL-ENGINE STATION AT BIG SPRINGS, TEX.

filtered for other parts of engines. In Table IX also an analysis is given for this oil after several filterings and specifications called for by the writer covering the range within which lubricating oils should be applicable to Diesel-engine use.

### LABOR ITEM IN DIESEL-ENGINE PLANTS

The question of labor has frequently been considered the "bugbear" of Diesel-engine operation. It has been the writer's experience, however, that any careful mechanic well versed in the theory of internal-combustion-engine operation can handle any Diesel engine satisfactorily with a minimum of difficulty. In the two stations referred to here in detail, and shown in Figs. 1 and 3, the men shown in Table X have been employed.

TABLE X—NUMBER OF MEN EMPLOYED AT PLANTS

| Classification | Paris | | | Tyler | | |
|---|---|---|---|---|---|---|
| | Number | Color | Rate per Month | Number | Color | Rate per Month |
| Engineer | 1 | White | $150 | 1<br>1 | White<br>White | $85<br>75 |
| Assistant engineer | 1<br>2 | White<br>White | 85<br>75 | 2 | Colored | 45 |
| Oiler | 1 | White | 60 | .... | .... | .... |
| Switchboard attendant | 1 | White | 75 | .... | .... | .... |
| Total labor | 6 | .... | $520 | 4 | .... | $250 |
| Average cost per man-day | .... | .... | $2.90 | .... | .... | $2.08 |

### ENGINE MAINTENANCE

The wide diversity of maintenance costs between the stations in Table V is accounted for by the facts that the Paris engines are of more modern design than the Tyler engines, the former having been operated but eight months, while the latter have done miscellaneous severe intermittent shop duty over a period of six to seven years prior to the installation at Tyler, and that during the period covered by Table V the Tyler equipment was subjected to certain extensive repairs and overhauling as a result of neglect prior to and at the time of its first trial in central-station service.

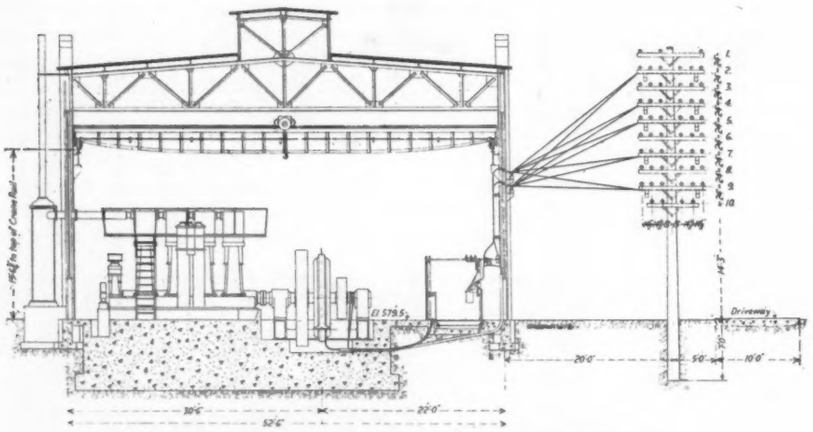


FIG. 9—SECTION THROUGH PARIS (TEX.) STATION

In this connection it will be of interest to note that upon close investigation of numerous accidents to Diesel engines practically all of them have been traceable to one of two causes—the neglect of mechanical features and faulty mechanical design. The chief cause of troubles seems to have been the former, which is the direct outcome of carelessness on the part of operators and which if practiced in the operation of steam or other type of equipment would have been fully as serious.

The length of life of the Diesel-engine parts has been estimated by those familiar with their operation as follows: Bed and frame, twenty years; crank shaft and governor, ten years; cylinder linings, six years; wrist-pin brasses, five years; cylinder heads, four years; pistons, piston pins, valves and gears, three years; piston rings, one year.

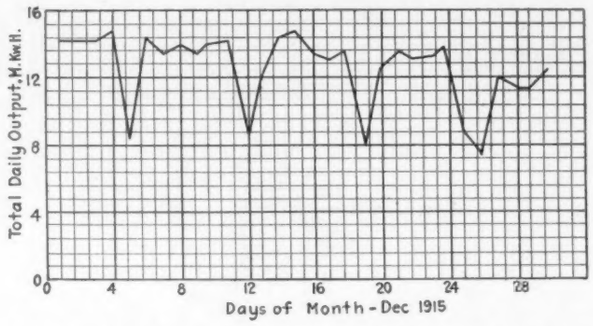



FIG. 10—TYPICAL DAILY OUTPUT FOR PARIS (TEX.) STATION

Summarized, this information shows a life equivalent to twenty years with one-third of the original cost expended on maintenance during that period, which estimate may be considered conservative.

### ACTUAL OPERATING COSTS

In the determination of costs under this heading, the actual monthly records of the Texas Power & Light Company for the periods noted have been consulted and are practically standard in public-utility practice. The two largest stations of the group noted in Table I—namely, the Paris and Tyler installations—have been selected, and Table V sets forth the production costs. This table shows "cost per kilowatt-hour" delivered at the switchboard for those plants covering periods of four months each.

To summarize the foregoing data and statistics, Table IV represents a fair estimate of operating results and costs which should result in a modern Diesel-engine electric generating station of 1000-kva. to 2000-kva. rating. As already stated, while the facts and data presented herein are the results of careful tests and efficiently handled equipment in stations of modern design and construction, they should not be taken as an absolute indication of what may be secured from Diesel engines installed in other localities and operated under different conditions.

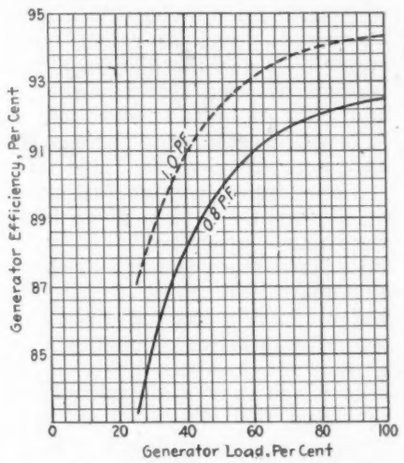



FIG. 11—EFFICIENCIES OF GENERATORS

# Calculation of Skin Effect in Strap Conductors

## A Method Derived from Test Results to Show Approximate Value of Skin Effect in All Shapes and Sizes of Strap Material

BY H. B. DWIGHT

A PRACTICAL way to calculate the skin effect in strap conductors—that is, the ratio of the alternating-current resistance to the direct-current resistance—would be of value to electrical engineers. Since a mathematical formula for widely separated strap conductors is not available, the best alternative is to derive an approximate value from the results of tests. Such an approximation has been worked out by the writer and may be obtained by using the curve of **Fig. 1.**

The laboratory results of a series of very precise measurements of the skin effect in certain sizes of strap conductors have recently been published.* When the results for widely separated straps are rearranged on a new basis somewhat different from the original one, the values of skin effect follow a straight-line law, as shown in Fig. 3, and an approximate law for all sizes may be deduced and used for practical work.

DATA SHOWING THE APPROXIMATE SKIN EFFECTS OF CABLE AND STRAP CONDUCTORS DERIVED FROM FIG. 1

| Thickness of Strap | Width of Strap | Diameter of Wire or Cable | Temperature, Deg. C. | $R$ = Resistance in Ohms per 1000 Ft. | $f$ = Frequency in Cycles per Second | $\frac{f}{R}$ | $\frac{R'}{R} = \frac{R \text{ a.c.}}{R \text{ d.c.}}$ |
|---|---|---|---|---|---|---|---|
| 0.1575 cm. | 1.26 cm. | ..... | −1.8°C. | 0.243 | 1,188 | 4,900 | 1.09 |
| 0.158 cm. | 2.52 cm. | ..... | 0°C. | 0.122 | 3,920 | 32,100 | 1.51 |
| 0.159 cm. | 3.81 cm. | ..... | 5°C. | 0.082 | 1,730 | 21,200 | 1.38 |
| $\frac{3}{16}$ in. | 3 in. | ..... | 25° C. | 0.0148 | 60 | 4,100 | 1.07 |
| $\frac{1}{4}$ in. | 4 in. | ..... | 25° C. | 0.00835 | 60 | 7,200 | 1.15 |
| 125,000-circ. mil cable | ..... | 0.408 in. | 25° C. | 0.0856 | 1,000 | 11,700 | 1.32 |
| 1,500,000-circ. mil cable | ..... | 1.413 in. | 25° C. | 0.00704 | 60 | 8,500 | 1.19 |

*"Experimental Researches on Skin Effect in Conductors," by A. E. Kennelly, F. A. Laws and P. H. Pierce, *Proceedings A.I.E.E.*, p. 1749, August, 1915.

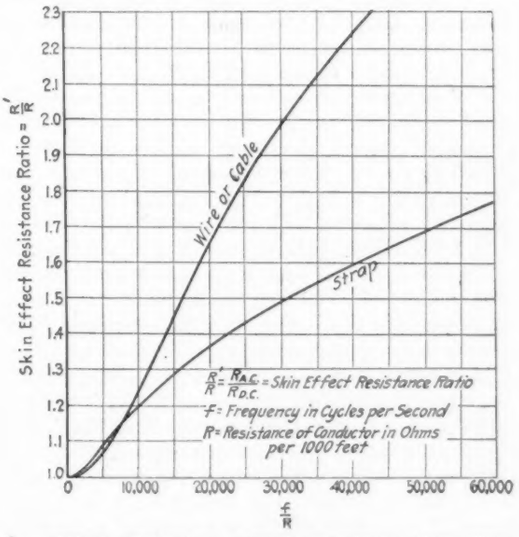

Skin Effect Resistance Ratio = R'/R
Wire or Cable
Strap
R'/R = Ra.c./Rd.c. = Skin Effect Resistance Ratio
f = Frequency in Cycles per Second
R = Resistance of Conductor in Ohms per 1000 feet
f/R

FIG. 1—CURVES FOR SKIN EFFECT IN STRAP AND WIRE CONDUCTORS

The curve for skin effect in strap, as shown in Fig. 1, applies to strap of copper, aluminum or other non-magnetic conductor. The strap should not be close to the return conductor; that is, there should be an air space between the strap and the return conductor somewhat greater than the width of the strap. The thickness of the strap should not be more than about one-tenth the width, otherwise the value of skin effect will lie intermediate between the curves for strap and wire. The curve applies to a single strap and not to the case where two or more straps are close together and connected in parallel as in ventilated busbars. The curve is applicable for any temperature, since the value of the resistance $R$ is to be taken for the temperature required.

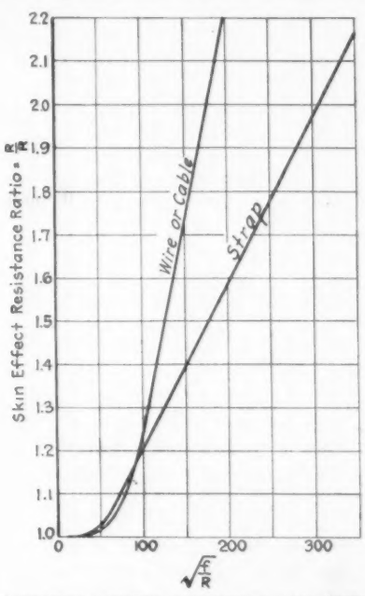



FIG. 2—SKIN-EFFECT CURVES FOR STRAP AND WIRE PLOTTED TO SHOW THE STRAIGHT-LINE FORM

It is well known that the curve for skin effect of a

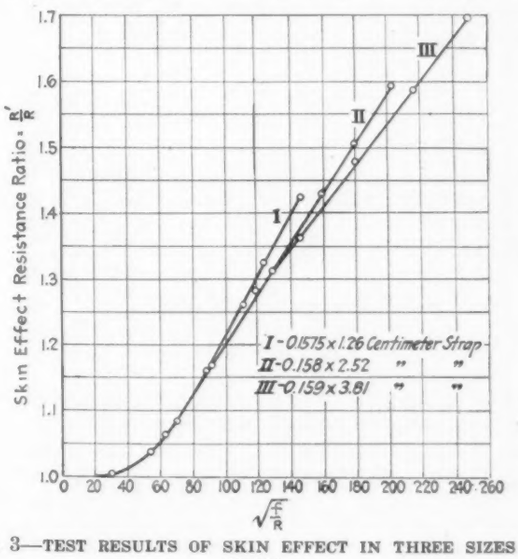



FIG. 3—TEST RESULTS OF SKIN EFFECT IN THREE SIZES OF STRAPS

round wire, when plotted against the square root of the frequency, as in Fig. 2, very soon approaches its asymptote—that is, the tangent which touches it at an infinite distance—and it becomes practically a straight line for high frequencies. This fact is made use of in calculating the skin effect of round wire for high frequencies, where considerable labor is saved by means of an asymptotic formula which applies to the comparatively straight part of the curve but not to the curved part.† It is seen from Fig. 3 that the skin-effect curve for strap also becomes equivalent to its tangent even sooner than the curve for wire. Moreover, the law for strap is similar to that for wire in that the skin-effect ratios for different sizes of conductors are close together when plotted on $\sqrt{\frac{f}{R}}$, and so one curve may be used for all shapes and sizes of strap, as in Figs. 1 and 2.

The table on page 593 illustrates the use of Fig. 1 in finding the approximate skin effect of either wire or strap. It is noticeable that the method of operation is simple and requires practically no calculation. It should be remembered that, while the curve for wire or cable depends on an exact mathematical formula, the curve for strap is an empirical one, and so gives only an approximation to the value of skin effect in a strap conductor.

# Operation of Interpole Direct-Current Machines—I

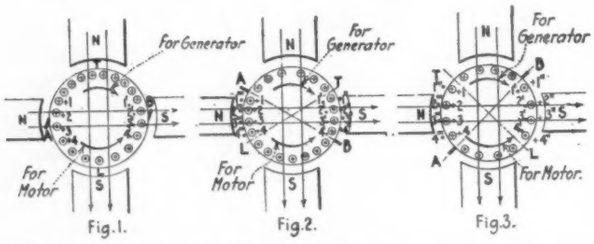
## Methods for Making Adjustments in Use on Manufacturers' Test Floors—Location of Correct Neutral Position for Brushes—A Second Section Takes Up a Study of Commutation

BY JUSTIN LEBOVICI

DIFFERENT methods for making the necessary adjustments of interpolar machinery to obtain the best results from its operation have been published from time to time. The methods in common use and employed on manufacturers' test floors, however, are not well known to the average operator. Since the interpole machine is usually adjusted for best performance in the factory test and these adjustments may be disturbed during shipment and are, of necessity, disturbed when repairs are undertaken, it is important that proper methods be used in all adjustments.

The interpole design was originally used as an antidote for certain commutation troubles, but has later been taken advantage of to obtain a greater output from a given amount of material through removing the limitations imposed on the design by commutation and thus making heating the only obstacle to larger outputs. By improving the methods of ventilation the burden imposed on the interpole grew and new problems came up in interpole machines which were of secondary importance only in non-interpole machines. Thus a slight shift of the brushes from the position of best operation in a non-interpole machine has little effect on the performance. In an interpole machine, on the contrary, a slight shift from the neutral position will produce a surprising cumulative or differential compound effect.

The explanation of this phenomenon can be easily




FIGS. 1, 2 AND 3—DIAGRAMS SHOWING EFFECT OF SHIFTING BRUSHES OF INTERPOLE GENERATOR AND MOTOR

followed by means of the accompanying diagrams. Fig. 1 shows the distribution of currents and emfs. in a generator running right-handed or a motor running left-handed. The interpoles induce in a generator the additional emfs. 1, 2, 3, 4, and 1′, 2′, 3′, 4′, having the direction shown. For circuit *ATB* the emfs. 1 and 2 are canceled by emfs. 1′ and 2′. For the circuit *ALB* the emfs. 3 and 4 are cancelled by emfs. 3′ and 4′. In consequence for the brushes in the neutral position, the voltage between the brushes *AB* is not influenced by the presence of the interpole.

The diagram in Fig. 2 represents the same machine as Fig. 1, with the brushes shifted from the neutral position forward for the case of a generator, backward for that of a motor.

The emfs. 1′, 2′, 3′ and 4′ generated by rotation in the interpole flux are opposing the emfs. in circuit *ATB* generated by rotation in the main flux. Similarly emfs.

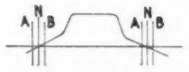



FIG. 4—NO-LOAD FIELD CURVE FOR INTERPOLE MACHINE

1, 2, 3 and 4 oppose the emfs. in circuit *ALB*. Consequently the potential between the brushes *AB* is reduced, owing to the presence of the interpole. Or less voltage will be generated if the machine is a generator, owing to differential compound action. If the machine is a motor, 1″, 2″, 3″, 4″—1‴, 2‴, 3‴, 4‴ are the emfs. due to the interpole. They reduce the counter emf. between *AB*, and the motor will move faster than with the brushes at neutral (differential compound action), because the counter emf. is reduced while the applied emf. remains the same. If the interpole flux is strong as compared to the main flux, the variation in speed between light load (interpole flux negligible) and heavy load may be quite marked, and the motor may become unstable or "pump." This pumping may be explained as follows:

Owing to the shift of the brushes from the neutral position against the direction of rotation of the motor, the counter-emf. is reduced as explained. Since the applied voltage is the same, the motor must speed up and the current in the armature will rise at the same time. In consequence, the interpole is strengthened and the counter-emf. still further reduced. This action will continue until, owing to the saturation of the interpole, the counter-emf., due to the higher speed of the armature, starts to reduce the armature current. If the inertia of the armature and motor load is great, the counter-emf. may rise above the applied potential and the armature will work as a brake. The action is again

†Formula No. 150, *Bulletin* of the Bureau of Standards, Vol. VIII, No. 1, p. 176.

reversed and a satisfactory operation becomes impossible. If the speed drops too much, the current may rise excessively and short-circuit phenomena may take place.

A similar action takes place if the interpole has too many turns, as will be explained later in this article. Fig. 3 is the same as Fig. 2, except that the brushes are shifted backward for a generator, forward for a motor. In a generator the emfs. 1, 2, 3, 4 are adding themselves to the emfs. in the circuit *ATB* and the emfs. 1′, 2′, 3′, 4′ are adding up to the emf. generated by rotation in the circuit *ALB*. It follows that the voltage between the brushes *AB* is increased in the generator. The speed is lowered in a motor when the brushes are shifted from the neutral position backward,

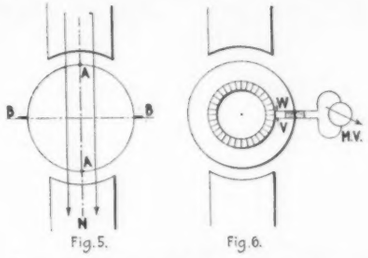



Fig. 5. Fig. 6.

FIGS. 4 AND 5—DIAGRAMS REFERRED TO IN METHODS 4 AND 5 FOR FINDING NEUTRAL POSITION

the emfs. 1″, 2″, 3″, 4″—1‴, 2‴, 3‴, 4‴ increasing the counter-emf. between *AB* so that the motor has to run slower for the same load current (cumulative compound action).

All reversible machines have to run with the brushes set at the correct neutral. In machines having only one direction of rotation advantage can be taken, if commutation allows, of the above action in order to obtain slight compounding. In all cases, whether the machines work with the brushes at neutral or not, the finding of the correct neutral position of the brushes as a starting point for the setting of the brushes is of paramount importance in all interpolar machines.

As a rule, the location of the correct neutral position is undertaken for one brush only, and the rocker arm is then shifted until one brush center coincides with this line. The other brush studs will be in the right position provided the machine is perfectly symmetrical. It will be well, then, to check the symmetry of the machine before determining the neutral position for one brush. It is assumed that the armature has been checked and found free from short-circuits, grounds or open-circuited coils; that the shunt and series coils are connected to give alternate polarity, and that no series coil is opposing a shunt coil when all the others are adding to their respective shunt coil. The variation in voltage drop for a given current in every shunt coil does not exceed 10 per cent, and the air-gap is the same under all poles.

It will further be necessary to check the distance between adjacent main-pole tips to see if they are evenly spaced all around and to check the distance between main-pole tip and adjacent interpole tip to see if they are equal. This can be easily done by means of an ordinary pair of calipers.

Brush spacing is of utmost importance and usually neglected. To space the brushes cut a strip of paper to the length of the commutator circumference. Place the strip around the commutator and make the ends touch each other. Divide off on the strip of paper equal divisions corresponding to the number of main poles and place the paper on the commutator again, making the brushes of each stud toe the mark. If there is any doubt as to the symmetry of the machine, it will pay to obtain the no-load field curve shown in Fig. 4.

## METHODS FOR FINDING NEUTRAL POSITION

The following methods may be and are employed in finding the neutral position:

1. With fields excited the machine is driven as generator without any load, a voltmeter being connected between a consecutive positive and negative brush. The rocker arm is shifted until the maximum voltage is read on the voltmeter. The neutral position corresponds to the position of maximum voltage. Owing to the fact that the flux tapers off between the poles, as in Fig. 4, hardly any difference will be noticed on the voltmeter when the brushes are shifted from the position *AA* through the neutral *NN* to the position *BB*.

2. The same objection attaches to the following method: The machine is run free as a motor, the rocker arm being shifted and the speed read on a tachometer. The position of minimum speed corresponds to the neutral position. Outside of the inaccuracy of a high-voltage voltmeter or a tachometer, there is the danger always present that the rocker arm may be shifted so far in the field that the generator will flash over or the rocker arm may slip and the motor run away.

3. Another method consists in running the machine as a motor in both directions, the field current being kept constant until the speed is the same for either direction of rotation. Owing to the fact that the voltage varies between the different readings and that many trials are necessary, this method consumes much time. When this method is used the brushes ought to be well worn in with but little play in the brush-holder box.

4. In the kick method, with the armature stationary and preferably the brushes removed from the commutator, the shunt coils are opened and closed in quick succession. A millivoltmeter is connected to two copper points which are held against the commutator, the points being one pole pitch (or the commutator circumference divided by the number of main poles) apart. The zero reading on the voltmeter indicates the neutral position. This method is based on the fact that if an armature is placed in an alternating flux, such as is shown in Fig. 5, for instance, then the emfs. due to the pulsation of the flux *N* are adding up along the line *AA*, and in a line *BB* perpendicular to the pole axis the difference in potential is zero. The objection to this method is that because of the slots in the armature the reluctance of the path to the flux varies with the position of the armature relative to the poles, and a different neutral is obtainable by turning the armature slightly.

5. The following method obviates this last objection: The machine the brushes of which are to be set is driven as a generator by means of an auxiliary motor, the fields being excited. The brushes are preferably all lifted from the commutator. Two contact wires *VW*, separated by about ⅛ in., are connected to a millivoltmeter and applied to the commutator about the neutral zone. The contacts are shifted until the millivoltmeter reads zero (see Fig. 6).

Between the points *VW* we read the emf. generated by rotation in the turns lying between these points. This emf. is proportional to the local field strength. In the neutral zone the field strength is zero, hence the zero indication on the voltmeter gives the neutral zone.

If it is not practicable to lift the brushes, the neutral position can be obtained with the brushes down and the rocker arm shifted to the so-found neutral. After this is done a new neutral is found. The actual neutral undisturbed by circulating currents under the brush, due to wrong brush position, may be found by few trials.

In the second section of this article, which will appear in an early issue, methods to determine the best commutation under the brushes and a study of brush-potential curves will be taken up by the author.

# Flexible-Plant Operation in a New York Bindery

## How Portable Individual Motor-Driven Units and Numerous Ceiling Outlets Permit the Most Economical Utilization of Factory Floor Space and of Machines

FLEXIBILITY of plant operation was one of the goals which the J. F. Tapley Company, bookbinder, New York City, set for itself years ago and has finally attained in a practical way by equipping machines and work tables so that each may be set in the most desirable location and operated as a unit. This has been done by attaching individual motors to every machine, mounting most of them on portable platforms, and providing numerous uniformly arranged ceiling service outlets so that units placed in any position can be connected therewith by short flexible conductors. The motors are installed and operated where they will collect the least dust and so they may be easily oiled and inspected and will not interfere with operations or passing employees. In many cases the motors are supported on frames attached to but installed above the machines. The motor starters and control equipment are also attached to each machine within convenient reach of the operator. Where needed, push-button control switches are installed in order that the motors may be stopped from convenient points. Lamps, electric heaters or blowers used in connection with apparatus are also permanently attached thereto and connected with the motor circuits, so that the electrical apparatus on each machine may be served in common by a single flexible conductor from a ceiling outlet. The portable idea has been carried out with such machines as light wire stitchers up to embossing presses weighing several thousand pounds. It was considered impracticable, however, with some machines, such as folders, although even with them the motors and control accessories have been made an integral part of the machines, so that they too may be moved as a unit to other parts of the building if desired. None of the machines are secured to the floors, as the transmission mechanism between the motor and the machine does not tend to shift it as might happen when apparatus is driven through belting from separately mounted motors or line shaft.

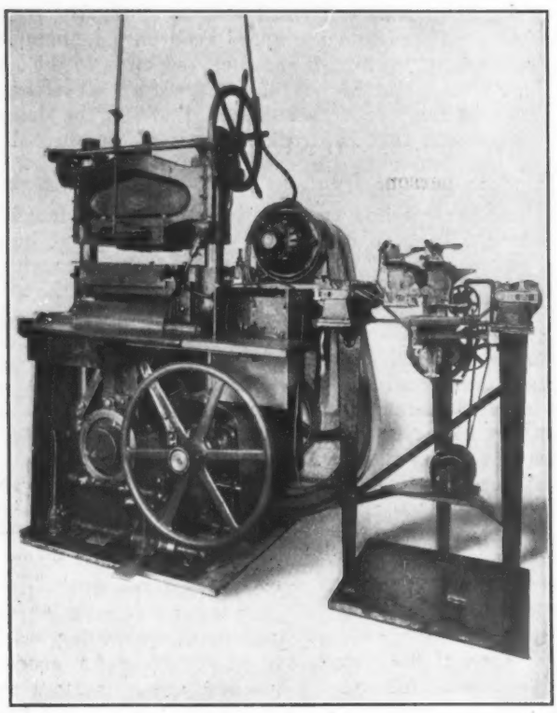


FIG. 1—INDIVIDUAL MOTOR-DRIVEN EMBOSSING PRESS AND PORTABLE GOLD-LAYING MACHINE SERVED FROM THE SAME CEILING OUTLET

It should be noted that while this embossing press is not supported on a movable platform, as most of the other equipment is, the motor and its starting and control equipment are attached to the frame, so that the apparatus may be moved as a unit when desired. The gold-laying machine, however, is supported on a movable platform having ball casters. The lamp in front of the embossing press is supplied with energy from the same circuit that serves the motors.

The work tables, shown in part in Figs. 3 and 4, are also made in units and are electrically equipped with glue-pot heaters, etc., and constructed so that the legs may be detached from the floor when the table is not required and the entire unit hung from the ceiling or otherwise stored out of the way. Lamps, heating devices and pilot signals are each rated at 220 volts and connected with a common switch and fuse cabinet on the under side of the table, one conductor only being connected with a ceiling outlet when the table is set in position.

### CEILING OUTLETS FOR SERVICE CONNECTION

The provision of ceiling outlets has simplified the distribution system considerably. Instead of running separate feeders from the main distribution board to each outlet, each cable feeds several receptacles. These have been arranged symmetrically at convenient intervals along the ceiling, and each row is connected by conduit running lengthwise of the building. In each conduit is a continuous cable designed to carry the maximum load which will probably be connected to it. When the ceiling outlet system, which is now only in the process of modification, has been completed, two rows of conduits, each serving about eight receptacles, will be

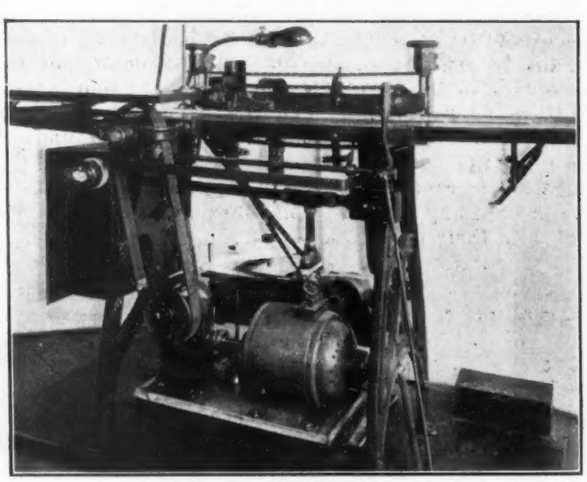


FIG. 2—PORTABLE STRIPPING AND REINFORCING MACHINE WITH ELECTRICAL ACCESSORIES SERVED FROM SAME CEILING OUTLET

A high-speed motor is employed with this machine, but its power is transmitted through worm gears and belts. Between the cut-out, starter and speed-regulator cabinet on the left and the motor the circuit is inclosed in conduit. At the right-hand end of the conduit is a push-button switch for controlling the motor. The machine is also equipped with an automatic electric cutter, the solenoid of which may be seen extending below the back of the machine table. Just back of the motor is an electrically heated glue pot, the circuit of which is controlled by the three-heat switch on the cut-out cabinet. A rotating drum partly immersed in the glue pot applies glue to the tape used in reinforcing.

provided between columns, giving a spacing of about 9 ft. between parallel conduits. The receptacles will be inclosed in specially designed sheet-metal boxes, each provided with a spring-trap door on the lower side so that dust is excluded and in order that the plugs may be easily inserted or removed. The plugs, which will also be specially designed, will each consist of two

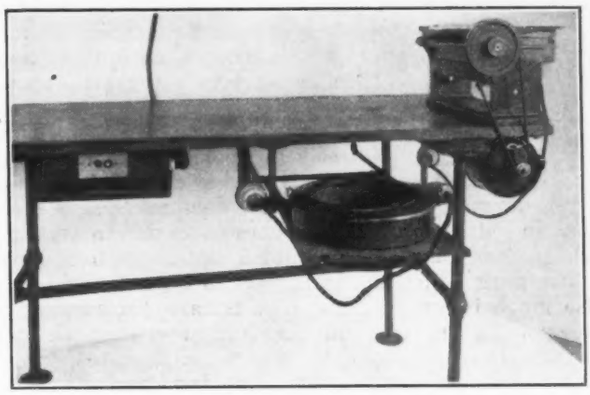


FIG. 3—SECTION OF ELECTRICALLY EQUIPPED BINDERY WORK TABLE

The table is equipped with a motor-driven electrically heated gluing machine and an electrically heated pot in which glue is stored for replenishing the glue machine at periodic intervals. All of the circuits are controlled from the cut-out cabinet beneath the table and are supplied with energy from the same ceiling outlet.

hinged insulating blocks carrying the conductor terminals and containing pockets in which the fuses may be inserted. The hinged construction has been selected so that the fuses will be inclosed but will still be accessible by unfolding the plug like the cover of a book. To prevent a short-circuit in case the portable unit is moved without first removing the plug, connectors are inserted in the cord so it will pull apart from any angle, thus leaving the energized section suspended from the ceiling.

So far 0.75-in. conduits containing No. 8 conductors have been installed and supported at outlet boxes, where the maximum stress occurs, by special strap-iron hangers secured to the ceiling by toggles. This equipment permits connecting a maximum load of about 35 amp. with each circuit, which is sufficient because all sockets are not in use at the same time and because the average rating of the motors employed in this plant is only 1 2/3 hp. Awaiting the installation of the fused plugs, No. 8 stage cable is being used between ceiling outlets and machines; therefore fuses are required only at the machines and not in the ceiling outlets since the drop cords are the same size as the mains. When the fused plugs are substituted they will be fused to correspond with the rating of the equipment they serve and smaller drop cords used where practicable. The fuses on the machines will be rated at a trifle less than those on the corresponding ceiling outlet plug; hence a gradual overload will open the machine cut-outs rather than the less accessible fuses in the ceiling plug.

Several advantages may be ascribed to this distribution system aside from the one of permitting short cords between outlets and machines. One is that men can fuse the plugs while standing on the floor and do not have to perform this operation while on ladder—a dangerous practice at best as a shock might knock a man off a ladder and cause serious injury. Another is that outlets in the floor are eliminated; therefore obstructions to the movement of machines and passage of employees are minimized and there are no pockets in the floor which might possibly collect dirt. A third advantage is found in the fact that the system is capable of being extended at any time by simply attaching more outlets to the conduit and replacing the old cable with a larger one in case the probable maximum load is increased. Furthermore, only a main distribution panel is needed, the individual-circuit fuses being in each plug. Again, the system permits machines being moved and connected up again without the delay and expense incident to calling in an electrician and waiting for insurance inspections.

Before when each machine was rigidly connected to its foundation and permanent connections were made for electric service considerable time was wasted in moving, owing to the necessity of removing bed-plate bolts, disconnecting wires, transferring machines, and reattaching and reconnecting them in the new position. Now the units can be moved almost as quickly as a sewing machine on casters, as each platform is supported on several ball rollers and reconnecting the motors requires only the simple operation involved in removing or inserting a plug.

### ADVANTAGES OF THE PORTABLE UNIT SYSTEM

To some persons the unit system may appear absolutely unnecessary. However, when it is considered that all jobs do not require the same machines, that some machines may be idle for long periods, that space may be needed for additional machines on some jobs, or that the time in transferring work between machines may be minimized by grouping units differently, it can be realized that facilities for making economic changes are valuable. Furthermore, employees who follow a certain fixed routine every day tend to work like machines. By changing the shop units around new interest is created and a more efficient mental atmosphere maintained. The Tapley company believes in this scheme to such an extent that it favors making changes in the entire book-binding plant at least once in every five years.

Aside from permitting more efficient operation, portable units can be viewed as a means of permitting the best utilization of floor space; in other words, every square inch of floor space can be employed for productive purposes. Idle machines which are moved out can be stored in a basement or loft where they will not take up valuable working space. Furthermore, when new

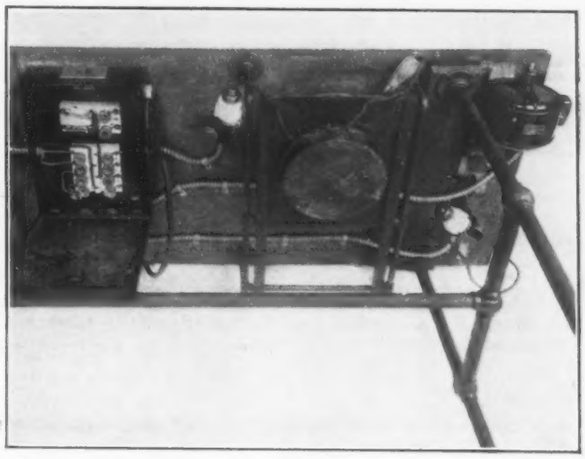


FIG. 4—BOTTOM VIEW OF BINDERY WORK TABLE

machines must be added the weights may be redistributed over the floors so they will not be subjected to unnecessary stresses.

All electrical modifications which have been made in this bindery were originated by Alfred C. Wessman, president of the Tapley company, and have been carried out by Herbert S. Patten, contracting engineer, New York City.

# Testing Plant Materials for Break-Down Voltage

## Methods for Checking Up Condition of Rubber Gloves, Floor Matting, Insulating Tape, Transformer Oil and Insulating Tools, with Points to Observe in Comparing Results

By H. A. Cozzens, Jr.

NOT infrequently in the power station the relative value of the insulating properties of materials in every-day use must be determined. The "safety first" propaganda has caused operating men to consider the status of protective material about the plant and to know, for instance, that rubber matting is what it should be in regard to the break-down voltage, that rubber gloves are safe to use, that rubber-insulated pliers have proved to be all that the manufacturer claims for them, and similar things about other appliances.

In a system where facilities are provided in the nature of a testing department and materials may be sent and tested under the supervision of experts, these investigations can be easily handled. With the smaller companies the cost of maintaining such a department is in most cases prohibitive, and the cost of sending every article which ought to be tested to a commercial laboratory is out of the question. Where such a condition exists a little ingenuity on the part of the electrical operating force will, however, make it possible to perform accurate tests on all materials used about the station.

The instance about to be cited is illustrative of what can be accomplished along these lines. Some years ago voltmeters were connected to oil-cooled transformers of the potential type which were later rendered obsolete by their size being out of proportion to their rating. A number of plants have transformers of this type hidden away in dark corners about the plant. Two of these were unearthed and checked for ratio, which was 120 to 1, while the rating was 200 watts. With the introduction of a few second-hand knife switches a very good scheme for testing materials was laid out, as shown in Fig. 1. On the secondary or 110-volt side the leads were connected from the line switch to a circuit-breaker. An ordinary dial-type and a carbon-type rheostat were placed in series as shown in the diagram. By use of these rheostats the voltage could be raised in the secondary from zero to 110 volts. By means of a double-throw switch the secondaries of the transformers could be placed in either series or multiple. The following table of switch positions shows clearly the voltage range and the operation of the outfit:

| Position of Secondary Switch | | Of Single-Throw Switches | |
|---|---|---|---|
| Up ..... Series | | No. 2, closed ..... Series | |
| Down ..... Multiple | | Nos. 1 and 3, closed .... Multiple | |
| Secondary | Primary | Ratio | Maximum Voltage |
| Series | Multiple | 60/1 | 7,500 |
| Multiple | Multiple | 120/1 | 15,000 |
| Series | Series | 120/1 | 15,000 |
| Multiple | Series | 240/1 | 30,000 |

A voltmeter was connected across the mains as shown, and by carefully watching the voltage as the test proceeded, and also when the breaker opened, the break-down voltage could be figured, knowing the ratio from the position of the switches.

### Standardization of Tests

Before illustrating practical methods of testing, a word about standardization of tests should be given. In all power-plant testing there is a basis on which to compare performance. In boiler tests results are figured on an equivalent evaporation. Turbine tests are corrected according to certain predetermined conditions. As a matter of fact all tests are standardized, otherwise the information secured by testing would be of no value since a comparison would be impossible.

In this connection it would not be permissible to change conditions for tests on the same article at different times if like conditions could be maintained. For instance, in testing rubber gloves the results would be misleading if one glove were immersed above the gauntlet and the other below, for if the glove failed in the seam the break-down voltage would be much greater in one case owing to the position of the seam. The standardization of tests is therefore important.

### Testing Rubber Gloves and Matting

When rubber gloves that may be known as linemen's gloves and guaranteed for a certain voltage become worn this guarantee becomes useless and the need for periodic tests becomes apparent. Another class of gloves, known as acid gloves, have found wide use. It

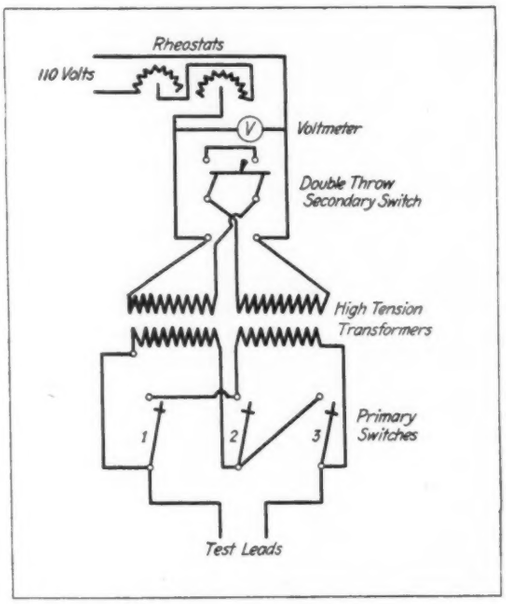
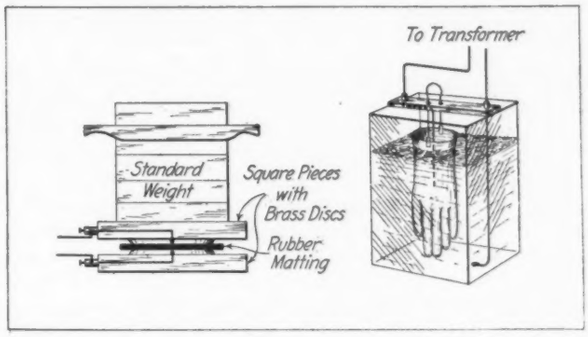



FIG. 1—AN OUTFIT THAT GIVES A VARIETY OF VOLTAGES

would not seem out of place to make an initial test on all gloves at a reasonable figure and prohibit their use on voltages in excess of this; also, arrangements should be made to test gloves immediately upon suspicion of a fault or upon evidence of heavy wear.

To test gloves a glass jar should be provided so as to enable the point of break-down to be observed. A suitable arrangement is shown in Fig. 2. This jar is partly filled with a brine solution or with fresh water, and the glove is also filled with the same liquid and immersed as shown in the illustration. The glove is supported by strings and clips. For gloves without a gauntlet the immersion should be such as to allow about 2 in. from the surface of the brine to the top of the glove. Gloves with gauntlets should be immersed so that the gauntlet seam is about 1 in. above the surface. These figures

are arbitrary and may be altered to suit individual conditions, but they should be kept the same for all gloves of the same class. The solution should be at the same level inside and outside the glove. One side of the potential is led by a chain into the jar, while the other is suspended freely inside of the glove. Break-down




FIGS. 2 AND 3—ARRANGEMENTS FOR TESTING RUBBER FLOOR MATTING AND RUBBER GLOVES

is detected by a hissing sound followed by a short arc and consequent tripping out of the breaker.

In front of many switchboards there is now placed a strip of some non-conducting material like rubber matting. This is usually found in railway stations or substations where one side of the circuit is grounded and the operator must close all switches and breakers on the ungrounded side. The need of matting in such places requires no explanation. Matting is subject to hard usage and question may arise as to the protection it affords the operator. A practical method for testing matting is shown in Fig. 3. Two pieces of board are provided about a foot square and about 2 in. thick. In the center of one side of each a brass circle is mounted about 4 in. in diameter and beveled at the edge. The connecting leads are attached to these plates. The matting is then placed between these brass plates, and sufficient weight is put on the upper block to exert pressure on the matting. It is advisable to standardize this weight or pressure. A box may be built of the same size as the blocks on which it rests and filled with sand to give the desired weight. The box can be fitted with handles and kept on hand especially for matting or fabric tests. A conservative figure for the weight is 100 lb. If an operator is walking on the matting, most of his weight is concentrated on one foot at a time, or if he is in the act of throwing in a switch or breaker the same holds true. Therefore it does not seem unreasonable to assume that the matting sustains a proportion of the man's weight to the extent of approximately 100 lb. at the point of greatest compression.

### TESTS ON TAPE

It is often found desirable to make tests on tape or insulating compound. These tests can be made by wrapping the tape around a piece of shaft, as shown in Fig. 4. The tape may be lapped as desired and the number of thicknesses decided upon according to the work. The clamp is so constructed as to give good contact with the tape and also to enable it to be moved along the bar. In this way several readings may be taken at one wrapping and the results averaged.

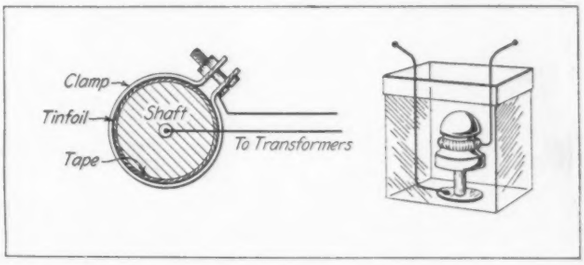
Instrument transformers which have been kept in stock for a long time and of which no accurate service record has been kept should be tested for proper insulation before reinstallation on circuits, as such precaution often results in much saving of time. The two primary leads should be tied together, and likewise the secondaries. One lead from the testing transformer should be tied to the primary side and the other lead attached to the secondary and the voltage gradually built up until a figure about twice that of the line voltage is reached. When the voltage has been applied for a minute and the insulation between the primary and secondary windings is faulty, a short-circuit will develop as in testing other materials.

### TESTING OIL FOR BREAK-DOWN VOLTAGE

Many power plants are now equipped with oil filter presses used for the purification of transformer oils. These presses are portable and consist of a series of filter-paper strainers through which the oil is forced by a pump. The press not only removes dirt and sludge but also the moisture from the oil, thereby increasing its insulating qualities. In conjunction with these filter presses it is well to have some means to determine the break-down voltage of the oil as an indication of the amount of purification needed. This may readily be determined with a testing transformer. A cup may be easily shaped from some insulating material like treated wood or fiber and terminals inserted in opposite sides. Terminals of round brass stock having faces about 0.5 in. in diameter may be used, separated so as to form a gap 0.2 in. in width. The two terminals should then be connected to a testing transformer and the cup filled with the oil to be tested. The voltage should be gradually raised until break-down occurs. The sizes quoted above are extensively used but are arbitrary, since any size can be used provided it remains the same in all tests. Several samples of new oil of the grade used should be tested and a break-down figure for new oil secured upon which all samples of oil to be purified may be based. The cup and terminals should be cleaned after each test and several break-down tests made on the same sample so as to get a fair average.

### TESTING SMALL INSULATORS AND TOOLS

Various other uses can be found in and about the power plant for the testing transformer. Small porcelain insulators may be tested, not only for break-down but also for arc over-characteristics and other features of design. A glass jar similar to the one used in glove testing may be filled with a good grade of transil oil in which strain and small pin-type insulators may be suspended. If the insulator be not too large in size for the output of the transformer, its break-down voltage may be obtained. The flash-over voltage of the insulator can be determined by mounting it on a metal pin to which a line from the set is led and placing a coil spring about the groove to which the other side of the transformer is connected. Insulated tools may be tested for




FIGS. 4 AND 5—CONVENIENT WAYS OF TESTING INSULATING TAPE AND SMALL INSULATORS

both insulation and leakage values in like manner by immersing them partly in mercury to which one side of the transformer is led and attaching the other side to the exposed metal of the tool. These are but a few of the many ways a testing transformer may be used about a power plant.

# STATION AND OPERATING PRACTICE

*A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy*

## Using Garage Synchronous Motor to Correct Line Power-Factor

How the Field Excitation of the Synchronous-Motor-Driven Generators Was Controlled Automatically for Power-Factor Correction During Day Operation

By Frank C. Taylor

Double duty is secured from a synchronous-motor generator set consisting of a 4150-volt, 268-kva. synchronous motor directly connected to two direct-current generators of 145 kw., 120 volts, and 45 kw., 90 volts, and a shunt-wound exciter installed in the garage of the Shafer-Decker Company at Rochester, N. Y. This set was originally installed to supply direct current for charging storage batteries on a contract arrangement with the Rochester Railway & Light Company, which offers a lower rate for energy used between the hours of 10 p. m. and 6 a. m. The day load of the garage is necessarily slight, since the trucks and pleasure vehicles are then in operation on the streets. In fact, only a few batteries are fed from the motor-generator set during the day.

The line serving the motor-generator set at this garage is well loaded during the day hours by an industrial motor load, of which the power-factor is approximately 70 per cent. The idea was therefore conceived to use the synchronous motor as a synchronous condenser; that is, to over-excite the motor during the day hours in order to improve the power-factor and voltage regulation of the line and to relieve this line of some of its kilovolt-ampere load.

To insure that the motor would draw full leading current during the day hours was quite a problem, since the employees of the garage could not be relied upon to make the necessary adjustments of the rheostats at 6 a. m. to over-excite the motor and at 10 p. m. to give

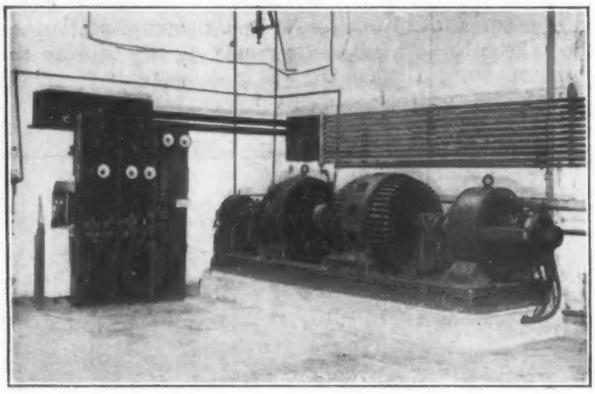


FIG. 1—SYNCHRONOUS MOTOR-GENERATOR SET INSTALLED IN A GARAGE AND USED FOR CORRECTING POWER-FACTOR

unity power-factor at full load. This problem was solved as stated below, the electrical connection being shown in the accompanying diagram: The motor and exciter rheostats were so adjusted at the maximum load, which occurred between the hours of 10 p. m. and 6 a. m., as to give normal excitation, that giving unity power-factor. Then, without changing the setting of the rheostats, taps were brought out from the exciter-field rheostat and connected to the terminals of a time switch. The function of this time switch is to short-circuit sufficient resistance in the exciter-field rheostat in order to increase the field current of the motor so that it will draw full-load current at a leading power-factor. The time switch is set to close at 6 a. m. and to open at 10 p. m.

Under normal operating conditions the time switch closes at 6 a. m. and short-circuits a portion of the exciter-field resistance. This causes the exciter voltage to rise, which in turn increases the field current of the synchronous motor and causes the motor to pull full-

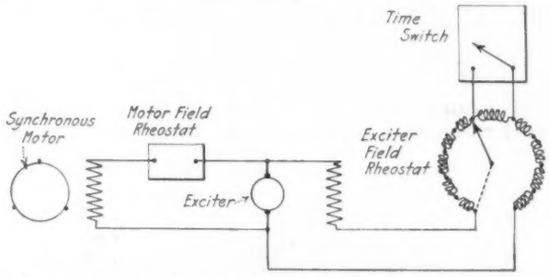



FIG. 2—CIRCUIT ARRANGEMENTS FOR OPERATING SYNCHRONOUS MOTOR AUTOMATICALLY WITH OVER-EXCITED FIELD

load current at leading power-factor. This condition exists until 10 p. m., when the time switch opens and removes the short-circuit from the exciter-field resistance. Then the motor operates at approximately unity power-factor.

The charge for the energy required is based on the maximum kva., consequently the only adjustment in which the consumer is interested is that corresponding to the maximum night load, which should be that adjustment giving unity power-factor. The following table shows the results obtained by the use of the synchronus motor during the day hours:

| | Total Kva. | Power-Factor of Line in Per Cent |
|---|---|---|
| Without the synchronous condenser..... | 502 | 70 |
| With the synchronous condenser..... | 400 | 93 |

The use of this equipment has thus reduced the kva. load on this line from 502 kva. to 400 kva. and raised the power-factor from 70 per cent to 93 per cent.

## Slag Binder for Protecting Steel Stacks and Sealing Boiler Settings

For three or four years, the Coshocton (Ohio) Light & Heating Company, now operated by the Ohio Service Company, has been using an inexpensive substitute for boiler-setting and smokestack paint. It is known as Barrett slag binder and costs 15 cents a gallon, as compared with $1.25 to $1.50 a gallon for high-grade paints. Several coats of the slag binder applied to the company's brick boiler settings have cut down the air leakage considerably. When applied to steel stacks it has retarded corrosion and has been found very satisfactory, not having cracked, flaked off or melted.

## Coal Purchasing on Specifications and Delivery Weights Effects Good Saving for Small Illinois Stations

In a paper entitled "Some Aspects of Boiler Efficiency" presented at the meeting of the Illinois State Electric Association H. J. Klotz of Decatur, Ill., said that the reports covering one year's operation of a certain group of fifteen Illinois steam-electric plants ranging from 1000 kw. to 9000 kw. in rating showed that the cost of coal averages 63 per cent of the total cost of generation. Prof. E. B. Parr, in a discussion of the paper, related his experience in purchasing coal on specifications for the University of Illinois and for seventeen charitable institutions in the State. During the first year this plan of purchasing was tried a saving of $20,000 was effected on the 200,000 tons of coal bought. Since coal operators have learned that they must meet the university's specifications the saving has not been so great, yet in 1915 it amounted to about $10,000.

H. J. Pepper of the Urbana & Champaign Railway, Gas & Electric Company advised central-station men who are seeking to reduce fuel bills to purchase and install track scales to weigh coal by cars. Since coal operators are now aware that such a scale is being used at Champaign, Mr. Pepper said he has been able to secure "full-weight" cars, whereas formerly the cars of coal received were from 2000 lb. to 3000 lb. short.

---

## A Method of Insulating Conductors at Angles of Tower Lines That Decreased Cost of Construction

BY H. B. SWEENY

In the illustrations of Fig. 2 the writer shows a method of insulating conductors on high-tension steel transmission towers at angles in the lines. The construction is a modification of that shown in Fig. 1, with jumper insulation improved and cost of installation considerably decreased. In Fig. 1 one side of a cross-arm on a tower at an angle in a transmission line is shown.

The conductor is insulated from the tower by the upright insulators *D* and *E*, by the strain-disk insu-

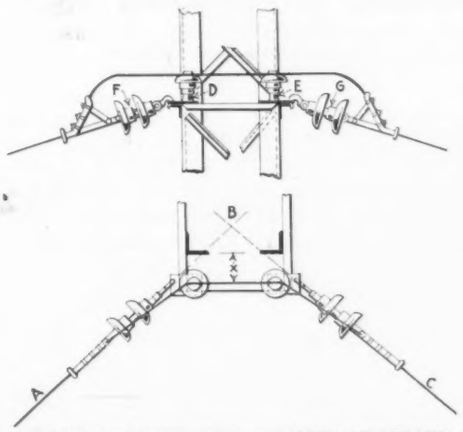



FIG. 1—METHOD OF INSULATING JUMPERS AT STRAIN CONNECTIONS IN ANGLES OF TRANSMISSION LINES

lators *F* and *G*, and by the air space between the conductor and the tower. In Fig. 2 the insulators *D* and *E* with their supports are removed and the shackles *H* and *I* inverted. The conductor is now insulated from the tower by the strain insulators *J* and *K* and the air space between the conductor and the tower. The conductor is below the cross-arm instead of above and does not require insulators to hold it away from the metal cross-arm.

This method of insulation improves the construction, in the writer's opinion, in three ways: (1) It does away with the upright insulators; (2) it increases the distance of the conductor from the side of the tower, as shown in Figs. 1 and 2, by comparing the distance *X*

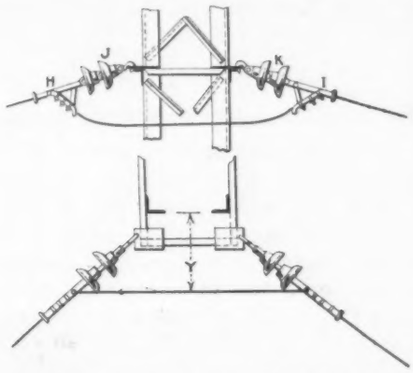



FIG. 2—A MODIFICATION OF THE CONSTRUCTION IN FIG. 1, WHICH REDUCES COST OF INSTALLATION

with the distance *Y;* (3) the cost of insulation of a two-circuit, three-phase system, which is the most common type, is decreased considerably at breaks in the line by doing away with all upright insulators and their lee-pin supports on one side. With tower lines of considerable length this decrease in cost of insulation is an important item. This type of construction is used on the transmission lines of a Pennsylvania company.

---

## A Peculiar Motor Action Caused by Service Transformer Connections

BY GEORGE W. TEFFEAU, JR.

One day during a heavy rainstorm a 5-hp., three-phase, 220-volt motor installed in a garage stopped suddenly, reversed its rotation for a few seconds, stopped a second time, and again reversed its rotation, blowing the fuses. A troubleman was sent for who diagnosed the case as one caused by a primary wire to ground or due to a transformer trouble. A new set of fuses was installed and the starting switch of the motor closed. The motor started to seesaw first in one direction and then the other for several seconds, finally coming to a standstill with a heavy growl.

When the writer reached the garage the owner said the same motor had reversed its direction on two other occasions, and that the direction of its rotation seemed to depend on the way the switch was closed. If the motor did not start in the right direction, he opened the switch, allowed the motor to stop, and kept on trying until it started in the proper direction. A voltmeter across the switch blades showed the voltage across phases 1 and 2 to be 220 volts, across phases 2 and 3 to be 220 volts, and across phases 1 and 3 the voltage varied from 0 volt to 440 volts, the voltmeter needle oscillating very much like a synchronizer. These readings indicated the trouble to be outside on the lines.

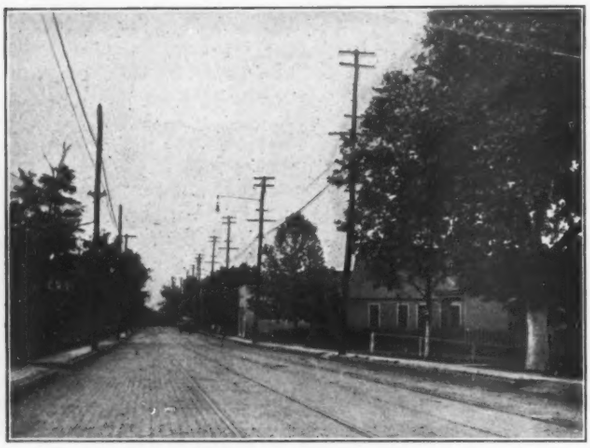
An inspection showed that the motor was fed from two transformers a block apart connected in open delta. As the secondaries were properly connected, it was suspected that the trouble must be in the primaries, as the voltage at the transformer secondaries was normal. Further inspection disclosed that a pole-top circuit tie switch was installed in the primaries between the transformers, and that this switch was open, consequently the transformers were on separate circuits and were

being fed from separate substations. The tie switch was closed, paralleling the two substations, and the trouble disappeared.

The excessive load at one station due to power and lighting lapping on account of the stormy weather caused a reduction of voltage on one transformer, and as a consequence the motor was acting as a balancer. The transformer connections were changed to feed from one primary circuit as a final remedy.

## Joint Use of Poles Betters Street Conditions in Memphis, Tenn.

In some of the streets of Memphis, Tenn., separate pole lines were formerly installed for electric-lighting, fire-alarm, long-distance-telephone, local-telephone and street-railway circuits. The operating companies have now effected an agreement which makes joint-pole-line



TYPICAL POLE CONSTRUCTION IN MEMPHIS (TENN.) STREETS

construction possible. The agreement was made on the joint-ownership basis, mainly for the reason that this method simplifies the system of charging the various companies. Since the new arrangement has been in effect wire casualties have been reduced to a minimum and the appearance of thoroughfares has been improved. A typical street is shown in the accompanying illustration.

## An Arrangement for the Interchange of Energy Between Isolated Plant and Central Station

BY CARROLL H. SHAW

The accompanying illustration shows an arrangement that has been worked out by the Sheboygan (Wis.) Railway & Electric Company to increase its generating-station rating from 2500 kw. to 3000 kw. at a lower cost than called for by the installation of additional generating equipment. The generating station is situated on the north bank of the Sheboygan River, adjacent to North Eighth Street, which is the main thoroughfare of the business section of the city. The district lying south and west of the river is fed through submarine cables laid 24 ft. below river level. This river crossing was installed during the season of 1915, and contains, with others, one cable of 3-4/0 stranded copper conductors suitable for 4000-volt service. New cable terminal houses containing switches and lightning-arrester equipment were built on both sides of the river, together with complete new lines leading to them.

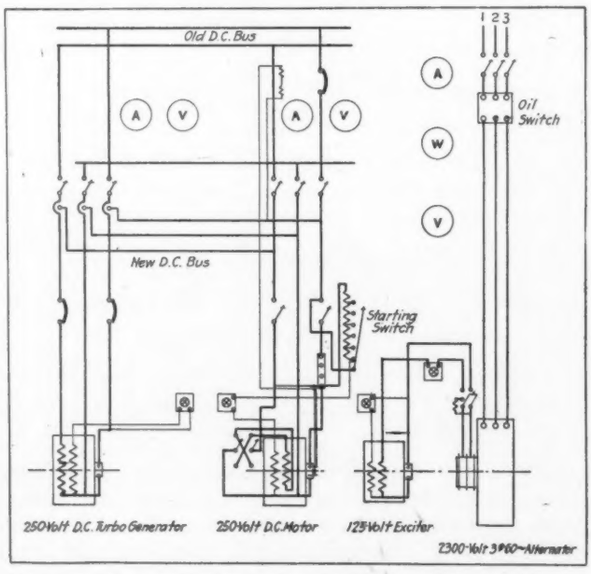
On the south side of the river, about 2000 ft. east of the terminal house, the C. Reiss Coal Company has a generating plant. This station has a total rating of 850 kw. in 250-275-volt direct-current machines, distributed in three units of 500-kw., 200-kw. and 150-kw. rating respectively. This equipment is used exclusively for the operation of extensive coal-handling machinery, including loading and unloading equipment for both vessels and cars, screens, elevators and an elevated cable-railway several thousand feet long. The general office of the company is also lighted from this station.

Owing to the fact that after Dec. 1 no coal is received by boat over the Great Lakes a large amount of this equipment is not in operation, and hence is available at exactly the time when the central station must carry its heaviest loads. An arrangement has therefore been made with the owners of this property whereby the central-station company has installed in the plant of the coal company a 500-kw. motor-generator set. This unit consists of a 500-kw., 2300-volt, sixty-cycle, 900-r.p.m. synchronous alternator, directly connected to a 700-hp., 175-volt direct-current machine with a 5-kw., 275-volt exciter mounted on the alternating-current end of the shaft.

The equipment is designed and installed for operation in either direction—that is, to enable the central-station company either to receive power from or deliver power to the busbars of the coal company's switchboard. The accompanying wiring diagram of the switchboard that has been installed with this machine shows how it is possible to operate all of the original direct-current machines in parallel with the motor-generator for the purpose of delivering power to the coal-docks equipment or to deliver power through the new unit to the central-station company. Furthermore, it is possible to operate the motor-generator either by the 500-kw. or the 200-kw. and 150-kw. machines combined, while the other unit or units are furnishing energy to the docks.

This arrangement for interchange of energy gives excellent results and is to be completed by the installation of a 25-kw. motor-generator set, which will be operated during the night by the central station in order to supply the needs of the offices, garages, dock lighting and other small requirements which have heretofore made it necessary to operate a 150-kw. steam unit at practically no load.

In the selection and operation of the transforming unit several interesting problems were involved, such as the advisability of using a synchronous converter,




CONNECTIONS FOR OPERATION OF A MOTOR-GENERATOR SET IN PARALLEL WITH DIRECT-CURRENT MACHINES OR TO FURNISH ALTERNATING CURRENT

the desirability of using a separate voltage regulator, the transformation from two-phase, four-wire, to three-phase, three-wire, and the proper management of the employees in the plant of the coal company. With the selection and installation of a motor-generator set without voltage regulation, and by placing the operators of the smaller station directly under the supervision of the chief engineer of the plant of the central station, all of these questions have been satisfactorily solved. It has been found very desirable to furnish considerable quantities of off-peak power to the coal docks, and although the motor-generator has been used regularly for the supply of peak-load current to the central station, at the present time the total consumption by the private plant has exceeded the amount required by the former.

Under this arrangement, therefore, both parties are able to operate their plants more efficiently. The private plant obtains an outlet at a time when it otherwise would be practically idle, and in return for a few hours' full-load operation is enabled to secure a supply of energy in relatively small quantities during more than ten hours of the day.

## How a Machine Foundation in a Substation Was Removed by Dynamite

A booster set in the Kolmar Avenue (Chicago) substation of the Commonwealth Edison Company has been removed to make room for a new 2000-kw. synchronous converter. A part of the reconstruction work incident to the change consisted in removing the booster foundation, which was built in a solid concrete block 12 ft. wide by 15 ft. long by 5 ft. high. To remove this monolithic block by manual labor would have taken eight men a week working eight hours a day with points and sledges.

A quicker and more efficacious method, however, was adopted. Working with air hammer and drills, a workman made twenty-five 1.5-in. holes varying in depth from 12 in. to 30 in. in the concrete. Two licensed dynamiters, whose services had been secured from the Chicago Surface Lines, then set and ignited fourteen dynamite blasts, which completely removed the old foundation. The man who drilled the holes worked from 2 to 11 p. m. on his part of the job. The dynamiters worked from 1.30 a. m. till 4.30 a. m. the following morning, firing the first blast at 1.30 a. m. and the last at 4.21 a. m. While the dynamiters were at work the two converters at the substation were shut down. This experience with dynamiting has led the company's engineers to believe that machine foundations inside of buildings can be more safely, speedily and economically removed by men who thoroughly understand dynamiting than by laborers with sledges and points.

A PART OF THE HOLE MADE BY DYNAMITE BLAST WHEN REMOVING MACHINE FOUNDATION

## Welfare of Firemen Is Considered by Illinois Company in Purchasing Boiler-Plant Equipment

In spite of the fact that the fixed charges on a system of overhead bunkers and stoker equipment for a plant of the Southern Illinois Light & Power Company of Hillsboro exceed the cost of labor for operating a hand-fired plant, the former type of equipment will be installed. In commenting upon the decision to use the more elaborate equipment, W. F. Corl, superintendent for the company, said: "It will be our aim to make life in the boiler room more pleasant for the firemen. We wish to relieve them of heavier tasks so that they may have more time to watch the flow-meter and other instruments and assure themselves that the plant is operating efficiently."

## Unit Operating Expenses of Several Small Wisconsin Utilities

Data collected by the Wisconsin Railroad Commission on the operating expenses of twenty small electric utilities serving communities of 2500 persons and less are tabulated herewith according to the classification of accounts prescribed in most States. It may be pointed out that the cost of generating energy in these particular cases is about 70 per cent of the total cost of supplying electric service. Next in order are the expenses of general supervision 11 per cent, of distribution 9 per cent, and of utilization 7 per cent. In the plants having annual outputs of 50,000 kw.-hr. or less the unit generating expense lies between 5.03 cents and 9.18 cents per kilowatt-hour, but in the stations having larger outputs the unit costs are lower, making the arithmetical average cost 5.42 cents and the weighted average 4.68 cents per kilowatt-hour.

OPERATING EXPENSES PER KILOWATT-HOUR GENERATED FOR SMALL WISCONSIN STEAM STATIONS

| Station Location | Population | Generation, Kw. hr. | Classified Expenses in Cents per Kw.-Hr. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Generation | Distribution | Consumption | Commercial | General | Undistributed | Total |
| Algoma | 2,300 | 97,580 | 3.36 | 0.25 | 0.10 | .... | 1.20 | 0.03 | 4.94 |
| Alma | 1,100 | 29,382* | 8.24 | 0.35 | 0.15 | 0.07 | 0.28 | 0.45 | 9.54 |
| Arcadia | 1,400 | 87,550 | 4.86 | 0.39 | 0.29 | .... | 0.40 | 0.09 | 6.03 |
| Athens | 1,200 | 103,920 | 4.17 | 0.13 | 0.29 | 0.03 | 0.28 | 0.04 | 4.94 |
| Cedarburg | 2,000 | 198,231 | 4.41 | 0.60 | 0.07 | 0.12 | 0.22 | .... | 5.42 |
| Chilton | 1,800 | 175,400 | 5.86 | 0.64 | 0.30 | .... | 0.74 | .... | 7.54 |
| Gillett | 800 | 24,400 | 3.01 | 3.53 | 0.12 | .... | 0.08 | .... | 6.74 |
| Mondovi | 1,325 | 30,000*‡ | 7.41 | 0.11 | 0.70 | 0.51 | 1.27 | 0.70 | 10.70 |
| Omro | 1,100 | 38,100 | 5.98 | 0.94 | 0.79 | 0.85 | 2.78 | 0.30 | 11.64 |
| Neillsville | 2,000 | 75,000 | 5.61 | 1.02 | 0.68 | .... | 0.40 | .... | 7.71 |
| Owen | 800 | 141,720 | 1.43§ | 1.16 | 0.20 | 0.08 | 0.35 | 0.04 | 3.26 |
| Pardeeville | 1,050 | 43,200† | 5.03 | 0.83 | 2.95 | 0.14 | 0.60 | 0.07 | 9.62 |
| Phillips | 2,500 | 250,000‡ | 3.54 | 0.20 | 0.11 | 0.08 | 1.77 | 0.10 | 5.80 |
| Rib Lake | 1,100 | 37,880 | 7.27 | 0.57 | 1.36 | .... | .... | .... | 9.20 |
| Rio | 700 | 22,000‡ | 9.18 | 0.18 | 0.45 | .... | 2.73 | .... | 12.54 |
| Sauk City | 900 | 34,500 | 6.81 | 0.25 | 0.27 | .... | .... | .... | 7.33 |
| Seymour | 1,100 | 45,400 | 8.78 | 0.86 | 0.23 | .... | 0.27 | .... | 10.14 |
| Sheboygan Falls | 1,630 | 65,000 | 4.29 | 1.25 | 4.11 | 0.03 | 1.85 | .... | 11.53 |
| Viroqua | 2,200 | 148,600 | 3.45 | 0.67 | 0.13 | .... | 0.11 | 0.23 | 4.59 |
| Bangor | 750 | 55,500 | 5.84 | 0.16 | 0.04 | 0.58 | 0.01 | .... | 6.63 |
| Weighted average | ..... | ..... | 4.68 | 0.62 | 0.48 | 0.09 | 0.76 | 0.08 | 6.71 |
| Arithmetic average | ..... | ..... | 5.42 | 0.70 | 0.66 | 0.13 | 0.77 | 0.10 | 7.78 |
| Median | ..... | ..... | 5.32 | 0.58 | 0.28 | 0.10 | 0.40 | 0.10 | 7.44 |

*Estimated. †Mostly purchased at 3 cents. ‡Both steam and hydraulic generation. §Burns mill refuse for fuel.

## "Wire-Your-Home Month" Display Distributed by Society for Electrical Development

In co-operation with electrical manufacturers and jobbers the Society for Electrical Development, Inc., has distributed among central stations, contractors and dealers material for some 10,000 of the "Wire-Your-Home Month" window displays illustrated. The printed matter for the standard display designed by the society consists of six 15-in. circles lithographed in eight colors, the banner 11 in. by 47 in. with the legend "Wire-Your-Home Month," the card picturing the hand and switch, twelve strips of paper tape, and stickers for fastening. The suggested arrangement is shown in the picture. Each circle pictures a room wired for electric service and shows some of the devices which may be used in the wired home. Different pieces of electrical equipment may be employed as the centerpiece and for dressing the sides of the window, the display being changed as may be desirable. The sets for the displays will be furnished gratis by the society on request.

# MARKETING ELECTRICITY

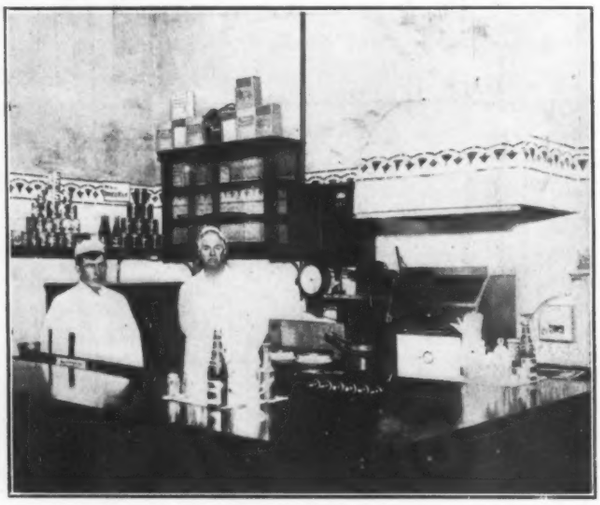
*A Department on Selling Service and Widening the Use of Electrical Energy*

## A Restaurant Range as an Advertisement for Electric Cooking

**A Practical Demonstration in a Hood River (Ore.) Restaurant That Has Interested Hundreds in Electric Cooking, While Returning a Substantial Income to the Central Station**

BY ALBERT S. HALL
Manager Hood River Gas & Electric Company

The advertising value of an electric range and other electric equipment in a popular restaurant can hardly be overestimated. Such apparatus performs daily before hundreds of persons interested in its operation. Meanwhile it produces revenue for the central station, whereas the average electric-cooking demonstration which is carried out at considerable expense to the central station and electrical manufacturer does not reach nearly so many people, and certainly not so effectively. The skeptic cannot avoid being convinced of the practical usefulness of the electric range after he has tasted a delicious dish prepared quickly before his very eyes. The cleanliness and rapidity of the operation are apparent, of course, without a word of explanation.



AN ALL-ELECTRIC RESTAURANT THAT DEMONSTRATES ELECTRIC COOKING TO HUNDREDS, MEANWHILE EARNING REVENUE FOR BOTH THE CENTRAL STATION AND ITS OWNER

An example of the publicity value of a restaurant-range installation—considered from the viewpoint of the central-station company interested in extending the local use of electric cooking—is the electric kitchen in the Merchants' Lunch, operated by L. V. Driscoll of Hood River, Ore., which has been in operation during the last six months. Here the cooking equipment and dining tables are in a large room, which also contains a soda fountain and a confectionery counter.

### DATA OF INSTALLATION

The electrical installation consists of a Hughes No. 50 electric range, the oven of which is used for roasting meats and making pastry. All the hot water required for the entire service is handled by a General Electric Type L-42 600-watt water heater connected to a 15-gal. tank not jacketed. An electric coffee urn equipped with a three-heat 880-watt hot-plate, with green and red pilot lamps which indicate the switch position, is used in the preparation of the coffee. The entire installation is served by a 220-volt, three-wire No. 6 copper circuit.

The restaurant serves about 300 meals each day and is open from 6 a. m. to 12 midnight. As a result of its electric service the place is so popular that it furnishes as many meals each day as the town's five other restaurants and two large hotels with which it has to compete; in other words, it has one-half of the total business of the city.

A maximum-demand indicator installed for a period of two weeks showed the five-minute peak load to be

5.5 kw. The rate for service is the company's standard "power" rate based on maximum demand, which is as follows:

Fixed charge: $1.25 per horsepower per month, plus 3 cents per kilowatt-hour for the first 30 kw.-hr. per kilowatt of maximum demand, 2 cents per kilowatt-hour for the next 60 kw.-hr. per kilowatt of maximum demand, 1 cent per kilowatt-hour for the next 120 kw.-hr. per kilowatt of maximum demand, and the balance at 0.5 cent per kilowatt-hour. Ten per cent discount is allowed on the entire bill. The average monthly net bill is $27.36 per month, or a return of $57.88 per year per kilowatt of maximum demand. The maximum bill for any one month was $27.95, and the minimum bill for any one month was $26.25. The average load-factor on a thirty-day, twenty-four-hour basis is 56 per cent.

THE PUBLICITY VALUE OF THE ELECTRIC KITCHEN

This restaurant installation has proved of immense value from an advertising standpoint, both in attracting business for itself and in its effectual publicity for the electric range. It is patronized by rich and poor alike. The prosperous merchant who has limited time for lunch takes pleasure in chatting with his fellow merchant while he watches his order prepared right before his eyes on the electric range. The busy apple-grower finds this a most convenient place to get a quick meal at any hour. The laboring man takes an equal satisfaction in having his food prepared under his own observation. A casual visitor can at any time of the day or night find a group of patrons discussing the merits of electric cooking. Among the patrons there are also to be found a liberal number of traveling men, attorneys and business men.

Maud Powell, the violinist, on a recent visit to the "Apple City," preferred the meals served at this electrical restaurant to those of the large hotels. While watching her dinner prepared she exclaimed enthusiastically: "I haven't seen anything quite so convenient. I am going to have just such a kitchen installed in my home."

Since this restaurant has been in operation two other restaurants in Hood River have adopted electric cooking, and it is a safe prediction that within the next twelve months every hotel and restaurant in the city will be equipped for this modern culinary method.

## Three-Cent Secondary Rate to Encourage Electric Cooking at Washington, D. C.

The Potomac Electric Power Company, Washington, D. C., has inaugurated a new electric heating and cooking schedule, the feature of which is a primary charge of 10 cents per kilowatt-hour for the first 10 kw.-hr. used during the month, while for all excess energy over the first 10 kw.-hr. 3 cents per kilowatt-hour is charged. In connection with this campaign the company is selling ranges on an easy-payment plan, $10 down and $5 per month.

During the month of March J. C. McLaughlin, manager of the commercial department of the company, has planned an electric display for the purpose of demonstrating electric cooking. This show will be operated throughout the entire month, and it is expected that some 20,000 visitors will attend the demonstration. As a premium the company will give a small portable lamp with each electric iron sold at the regular price of $3. The local contractors and supply men have been invited to make exhibits, and there will be demonstrations and lectures each afternoon and evening on the subject of electric cooking.

## "Houses Are Easily Wired for Electricity"

The ease and cleanliness with which already-built dwellings can be wired for electric service is well presented in the booklet "Houses Are Easily Wired for Electricity" which has just been issued by the publications committee of the Commercial Section of the National Electric Light Association for use in the coming "Wire-your-home" campaign, March 15 to April 15. The booklet contains twelve 4¾-in. by 7-in. pages and is illustrated with a number of halftones showing wiremen at work and emphasizing the slight muss and interference with the household incidental to a modern house-wiring job.

Following an enumeration of the conveniences and advantages of electricity in the home, the simplicity of the operation of wiring an existing dwelling is succinctly set forth in these paragraphs:

"You need not deny yourself and your family the comforts that electricity affords—

"Because any house can be wired without marring the walls or fixtures,

"And without greatly disturbing the routine of the home.

"The method is simple.

"The rugs are rolled back, one strip of flooring is taken up, and the wires are laid on the beams.

"Small holes are cut in the side walls for switches, in the ceiling around the gas pipe for the wires that connect to the fixtures, and in the baseboard for 'outlets.'

"The wires that connect with the switches, baseboard outlets and the different floors are 'fished' between the walls.

"When the job is completed *all the wires are hidden* between the walls and under the floors.

"The switches cover the holes in the side walls, and the fixtures hide the outlets in the ceiling.

"No one would ever suspect that the wiring had not been done at the time the house was built.

"There is no discomfort or annoyance to the family.

"And you will be surprised when you learn how cheaply the wiring can be installed."

The booklets are furnished with special envelopes, and they cost to mail 1 cent each. The booklets are offered for sale by the publications committee of the Commercial Section of the N. E. L. A. and by the Soci-

THE N. E. L. A. BOOKLET FOR DISTRIBUTION TO PROSPECTIVE CUSTOMERS DURING "WIRE-YOUR-HOME MONTH"

ety for Electrical Development, Inc., 29 West Thirty-ninth Street, New York City, at the following prices, which are f.o.b. New York City, and which include imprinting the booklets with the company's name:

| | |
|---|---|
| Per 1000 copies | $20.00 |
| Lots of 500 | 12.50 |
| Lots of 250 | 7.50 |

Where the company's imprint is wanted on the envelopes as well, an extra charge of $1.50 will be made.

## Time-Basis Versus Contract Jobs in House-Wiring Work

"It is remarkable how business conditions have changed in electrical contracting," said L. A. Fleury, an electrical contractor of 421 Massachusetts Avenue, Indianapolis, Ind., during a recent discussion of the work of the electrical contractor and methods of paying for wiring work.

"Twenty years ago, when we started in business, practically all work was let by contract. If the contractor figured high on the 'element of safety' he got probably more than the work deserved, while those who figured too low and found themselves 'in a hole' played even by skimping the job.

"After a period of this set-price work, the 'time-and-material' basis came into vogue, but here, too, there were unscrupulous contractors who took advantage of the people, and for a while buyers were skeptical about the new plan.

"However, the contractor who gives service, quality and reasonable prices has succeeded in educating the public to an understanding of the high merit of the 'time-and-material' system, and now most persons recognize that this is the logical way in which to have any class of mechanical work done.

"People have learned that it is best to go to a reputable firm—one that has demonstrated by its length of life and its constant growth that it is worthy of every confidence—and pay only for such time and material as they actually receive.

"Ten years ago nine-tenths of our work was on a contract basis. Now practically all of it is on the basis of 'pay only for what you get.' In our own case the fact that our volume of business has quadrupled in five years indicates, in our opinion, that our customers have been well satisfied with the 'time-and-material' plan."

## Master-Switch Control Circuits for Large Residences

By Fred Latzer

While the "burglar-lamp" circuit using standard three-point switches with single-pole master-switch control is satisfactory for small dwellings, it has several limitations when such burglar-lamp protection is to be applied to installations in large residences. Obviously, either all the lamps on a given fixture or group of fixtures must be placed under the control of the master switch, or, if only one or more lamps on such a large fixture are to be master-controlled, this smaller group must be provided with an independent local switch, or these lamps under the master switch must remain unlighted except when energized through the master switch itself.

In the case of a large fixture or group, the number of lamps which may be placed on the circuit is limited to not more than sixteen 40-watt lamps. Consequently in a residence of any size two or more single-pole switches would be required, each controlling not more than sixteen lamps. If the smaller group of "burglar lamps" on the fixture is provided with a special local switch, the operation of such switches is inconvenient and the expenditure for these extra switches may be considerable in the case of a large building. If, on the other hand, these "burglar lamps" are to be allowed to remain dark

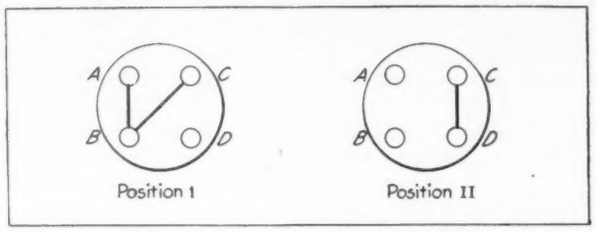



FIG. 1—CONNECTIONS EFFECTED BY SPECIAL SWITCH

except when energized through the master switch, objections on the score of appearance may be interposed. A fixture with a large number of dark lamps is seldom tolerated by the architect unless these dark lamps can be well hidden, and in that case their light is usually very much obstructed and the emergency lighting sought will be greatly interfered with.

A system has been lately developed, and is now in successful use in several large residences, whereby the defects above outlined are avoided. Use is made of a special switch for each fixture. This switch, which is shown in the accompanying sketch (Fig. 1), takes the place of the usual local single-pole or double-pole switch and costs very little more than either. The sketch (Fig. 1) shows the connections made between terminal posts of the switch for each of the two positions. In appearance the switch resembles the usual flush-type switch with two push-buttons. Fig. 2 shows a complete wiring diagram of this system.

The polarities of posts *B* and *D* should be alike, otherwise with the switch in position II and the master switch closed, the emergency lamp (shown shaded) will not light. In three-wire systems care must be taken to place all the fixtures having emergency lamps on one side of the system. This can be easily done if the wireman is made aware of the requirement when connecting his circuits to the distribution boards. In connection with this fact it may be well to point out that circuits supplying post *B* may be taken from the nearest panelboard, as many circuits being used as necessary. It is also well to provide a separate circuit feeding the master switch, although this is not essential. Of course, only one polarity of this circuit is used. It is seen that

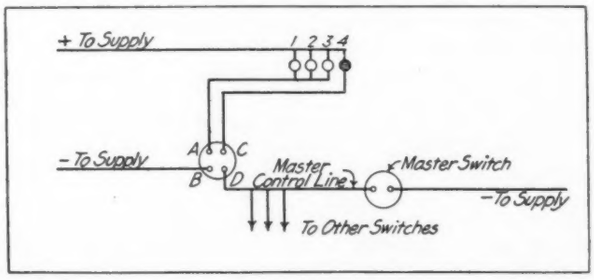



FIG. 2—THE SPECIAL SWITCH IN USE WITH BURGLAR CIRCUIT

with the local switch in position I all lamps obtain current from the local circuit; in position II lamps 1, 2, 3 are dark and lamp 4 is connected through to the master switch ready for emergency use. The fixture then has the appearance of being controlled from the local switch only, and all lamps are either dark or burning when the master switch is open.

The system as above outlined cannot be used on fixtures controlled by three-point switches. To overcome this obstacle the following method has been devised: The three-point switch at one end is discarded and a standard four-way switch used instead. The switch at one position connects posts *A* to *D* and *B* to *C* in the other position *A* to *C* and *B* to *D*. The lamps are then

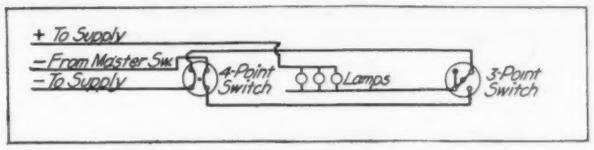



FIG. 3—FOUR-POINT SWITCH COMBINED WITH MASTER-SWITCH CIRCUIT

receiving current either from the master switch or from the local supply. It is to be noted that all lamps on each fixture thus controlled must be on or off. This is no serious objection, as fixtures so controlled are usually in staircases and do not contain more than sixteen lamps in all.

When the number of lamps does become large special devices must be employed. A good example of one is at present installed in a six-story residence on upper Fifth Avenue, New York City, the diagram of which is given in Fig. 4. The emergency wiring in this building is divided into two distinct parts, one consisting of lamps scattered throughout the building, on small and large fixtures, in family bedrooms and living rooms. The total number of lamps under direct master control is about thirty, and they are divided about evenly on each leg of the double-pole master switch (this switch is here used as two single-pole switches operated simultaneously). The other part of the system consists entirely of lamps in halls and on staircases controlled by three-point and four-point switches. The emergency master control is accomplished as shown on the diagram. The master control wire is continued to a central location and terminates at the 120-volt relay shown. Shunting leads are also brought to this location from each of the stair and hall circuits, these terminating at the relay contacts as shown for one of the circuits. When the master control switch is closed the relay *A* is energized and its armature completes the circuit through each of the staircase circuit relays, whose armature in turn completes the shunting of the local control switches and so energizes all circuits. Springs return the armatures to the open position when the master switch is opened.

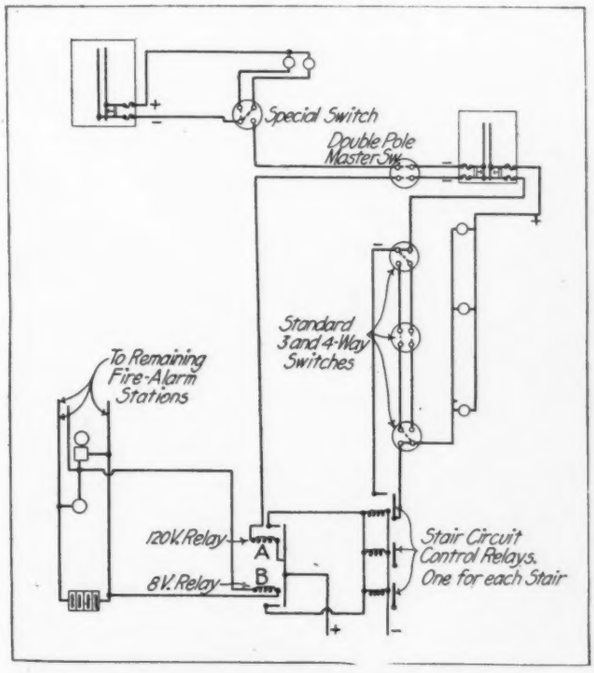



FIG. 4—RELAY CIRCUITS COMBINED WITH STANDARD FOUR-POINT SWITCH CONNECTIONS

This building is equipped with a local fire-alarm signal system. The operation of any station will automatically turn on all the stair and hall lights through the closing of relay *B*'s armature. This is a very valuable addition to the alarm equipment, for it is well known that in case of fire most people become too panic-stricken to give coherent thought to their actions, and the excitement of an alarm becomes very much lessened when the passages of the house are brightly illuminated.

Any number of variations of this system may be had to fit the needs of particular buildings. The apparatus above described costs very little, its upkeep expense is nil, and the amount of protection it gives is a very good insurance.

## An Elaborate Flasher Effect in Cleaner's Large Electric Sign

A Denver (Col.) dry-cleaning firm has placed an unusually elaborate electric sign over the front of its store, in the operation of which the firm's name is first flashed out in bold white lettering, extinguished, and relighted in reduced size in red lamps, which are set within the outlines of the large white letters. During the interval between lighting and extinguishing the name in the two sizes, a border around the whole sign is lighted with a zigzag movement in four colors spelling out the words: "Cleaning, Pressing, Dyeing and Repairing." This advertising feature is in effect from dusk until midnight. A space measuring 15 ft. by 20 ft. is occupied by the sign.

## Ornamental Lighting at Omaha, Neb.

A striking example of orginality in ornamental lighting is shown in the accompanying photograph of one of Omaha's leading department stores. This interesting display is achieved by the use of twenty-four 750-watt gas-filled tungsten lamps, mounted on special cast-bronze ornamental standards and brackets designed to conform to the architecture of the building. The effect is most pleasing and appealing to the eye, and the installation has proved itself a great attraction for the Brandeis store.

ORNAMENTAL LIGHTING WITH TUNGSTEN FIXTURES ON THE BRANDEIS STORE, OMAHA, NEB.

# Making Central Steam Heating Pay

**Advantages of Atmospheric System Revealed in Tests Conducted by Illinois Central-Station Company on Different Classes of Service**

The Urbana & Champaign (Ill.) Railway, Gas & Electric Company has 210 steam-heating customers, who in the aggregate are operating about 210,000 sq. ft. of radiating surface. On this system tests have been conducted lately which, according to J. H. Pepper, the company's superintendent, show why the steam-heating business has not proved more profitable in the past.

From the table it will be seen that the customers operating atmospheric systems on a meter basis are by far the most profitable to the central station. In comparing the steam quantities used Mr. Pepper pointed out the fact that the flate-rate, one-pipe customers regulate their room temperatures by opening or closing windows, while those with atmospheric systems use the radiator valves to regulate the flow of steam to their radiators.

The one-pipe customers and those designated as having "other systems" are not receiving the best of service in spite of the fact that 2-lb. to 4-lb. pressure is being maintained at the services. The customers with atmospheric systems require but from 3-oz. to 6-oz. pressure to receive good service. The atmospheric system employs no cooling coil, yet the condensate going to the sewer varies in temperature between 90 deg. Fahr. and 110 deg. Fahr. Other systems with cooling coils deliver the condensate to the services at temperatures ranging between 160 deg. and 200 deg. Fahr. In view of the results shown by the tests, Mr. Pepper said that the adoption of the atmospheric system for customers' premises offered a means of making central heating a paying business.

STEAM-HEATING SERVICE, SEASON 1914-15

| | Mean Temperature During Heating Season | Total Cubic Feet Space | Total Square Feet Radiation | Total Pounds Condensation per Season | Ratio Radiation to Space | Total Pounds Condensation per 1000 Cu. Ft. of Space | Total Condensation per Square Foot of Radiation |
|---|---|---|---|---|---|---|---|
| Twenty-six consumers atmospheric system meter | 39.30 | 2,940,975 | 40,265 | 12,436,000 | 1 to 73 | 4,228 | 308 |
| Twenty-six consumers other system meter | .... | 1,557,786 | 20,517 | 11,156,000 | 1 to 75 | 7,161 | 543 |
| Twenty-six consumers flat-rate one-pipe system | .... | 945,061 | 13,332 | 13,210,000 | 1 to 70 | 13,977 | 990 |

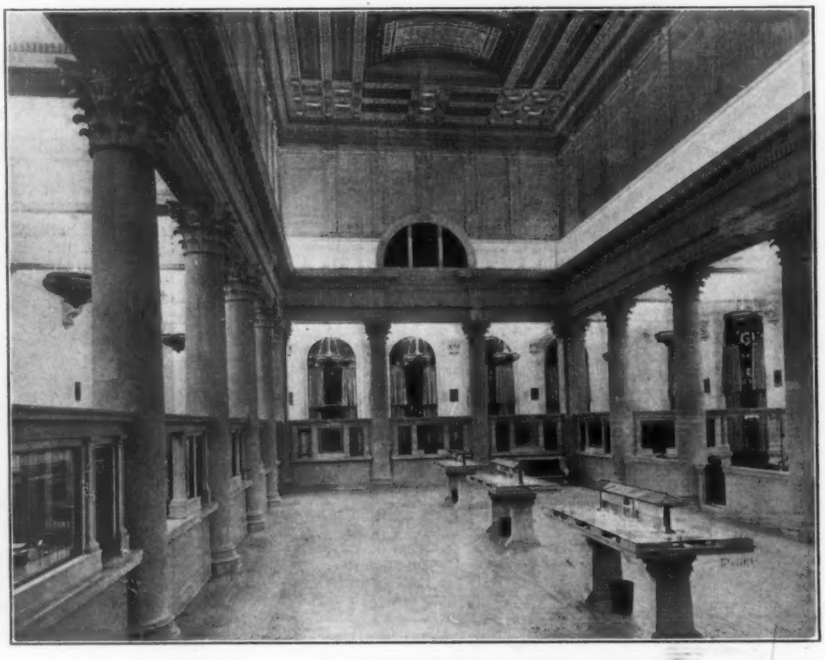
## How Cove and Fixture Lighting Were Combined in the United States National Bank of Omaha, Neb.

A combination of artistic and utilitarian lighting equipment which harmonizes with its surroundings and at the same time provides illumination that adequately meets exacting lighting requirements has been made in the new banking room of the United States National Bank of Omaha, Neb. Indirect lighting was chosen for this building because from the architectural standpoint the lighting of the walls, ceiling and other decorations was of importance in addition to the adequate illumination of the working plane. The several methods employed in the banking room have made possible a consistent and uniform treatment of all spaces by the means best suited to each area. In the public lobby, which would be difficult to handle with fixtures, cove lighting was used with excellent results. In the tellers' cages and working spaces fixtures were employed because they lend charm to the otherwise blank ceiling spaces between the beams.

The illumination of the public lobby is accomplished by means of a battery of eighty-six reflectors and 60-watt lamps extending around its four sides, as explained in detail in the specifications accompanying the illustration below. These reflectors are installed in a cove within the cornice at the top of the entablature resting on the Corinthian columns.

In the tellers' cages and working spaces around the four sides of the public lobby indirect-lighting fixtures contain 400-watt nitrogen-filled tungsten lamps.

The lobby of the United States National Bank, Omaha, Neb., measures 78 ft. by 34 ft. in plan, the distance from the floor to the ceiling being 40 ft. The cornice within which the reflectors are placed is 22 ft. above the floor, making the throw of light from the top of the reflectors to the ceiling approximately 18 ft. The central portion of the ceiling is taken up by a skylight 52 ft. by 14 ft. This skylight is made of art-glass panels. The equipment used in the cove comprises X-ray reflectors carrying 60-watt tungsten lamps. In all, eighty-six units are installed, making the total connected load in the cove 3160 watts. The reflectors are spaced so as to secure as nearly uniform illumination over the ceiling as possible. They are tilted at a considerable angle from the vertical to avoid a non-uniform or scalloped effect on the walls just above. In order that the art-glass panels of the skylight might not appear dead, reflectors and lamps were placed above them. For this purpose fourteen reflectors with 60-watt tungsten lamps were installed. They were suspended at a sufficient distance above the skylight to produce uniform and diffuse distribution of light over the glass and to eliminate bright spots.



INDIRECT COVE AND FIXTURE LIGHTING, UNITED STATES NATIONAL BANK, OMAHA

# ADVANCE IN TECHNICAL THEORY AND PRACTICE

*Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World*

## Manufacture of Artificial Ice by Central Stations

**Results Obtained in Actual Practice in Germany—Arrangement of Plant, Cost of Production, and Profit**

IN view of the increasing interest taken by American central stations in artificial ice-making as a means for improving the load-factor during the summer months, the record of the results obtained in Germany in this field, recorded by Richard Pabst in the *Elektrotechnische Zeitschrift*, Jan. 20, is interesting. The two oldest German ice plants, which have been in commercial operation in connection with central stations for three or four years, are at Steglitz, a suburb of Berlin, and at Oberhausen, in Rheinland. The maximum daily production at Steglitz has been 120 tons of ice and at Oberhausen 30 tons, but the capacity of the latter plant is now being doubled. Fig. 1 shows the arrangement of the Oberhausen plant (which produces 30 tons in twenty-four hours), an installation typical of German practice. Ammonia compression machines are employed.

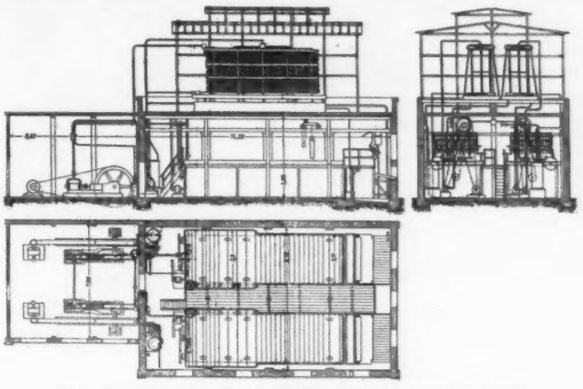


FIG. 1—DESIGN OF GERMAN ICE-MAKING PLANT

To make up a cost sheet, the ice plant may be assumed to be in operation for 4500 hours during the year. In the hot summer months it is in operation for twenty-four hours a day, while in the winter months it is operated for only a few days for ten or twelve hours. Fig. 2 gives the load curve of the Steglitz station for the months from April to December, the ordinates being kilowatt-hours. Curve *a* gives the kilowatt-hours generated exclusive of those used for ice-making. Curve *b* gives the kilowatt-hours inclusive of those used for ice-making. The shaded areas therefore represent the kilowatt-hours used for ice-making. While this consumption becomes largest in July and August (more than 80,000 kw.-hr. each month), it will be seen that some ice is also made even in November and December, when less than 20,000 kw.-hr. per month is consumed. At both Steglitz and Oberhausen the central-station accounting department charges the ice department for energy at the rate of 1.5 cents per kilowatt-hour. For the water which is to be converted into ice potable water from the municipal supply system is used at a charge of 2.5 cents per cubic meter ($94.60 per 1,000,000 gal.), while for the cooling water 0.75 cent per cubic meter ($28.40 per 1,000,000 gal.) is charged. For 1000 kg. (2205 lb.) of steam needed for separating the ice blocks from the cell walls, 75 cents is a sufficient charge if the station pays $3.50 per ton of coal delivered; for 50 kg. ice (110 lb.) there is needed 2 kg. (4.4 lb.) of steam. For a plant operating 4500 hours a year and producing 1000 kg. (2205 lb.) of ice per hour, or 4,500,000 kg. per year, 220,500 kw.-hr. is required. This gives a specific energy consumption of 49 kw.-hr. per metric ton (2205 lb.) or 44.5 kw.-hr. per short ton (2000 lb.) of ice produced.

A cost sheet is given by the author for a plant having a capacity of 1000 kg. (approximately 1 ton) of ice per hour. Five per cent interest is charged on the capital investment, 10 per cent amortization on the machines, and 2 per cent amortization on the buildings. The total capital investment is $25,000. One machinist is needed for the whole year (wages $450 a year) and three additional men for 200 days for three hours and two additional men for 100 days for three hours (wages 10 cents per hour). In view of these figures for wages the cost sheet would, of course, be different for American conditions. The total yearly cost of operation (including interest charges) is found to be $8,500, and as 4,500,000 kg. of ice is produced, the total cost is 8.6 cents per 100 lb. of ice. For larger plants this cost may be reduced to 7.5 cents, while for smaller plants it will be higher. It is very important, however, that the capacity of the ice plant be correctly adapted to the needs of the municipality so that the installed machinery shall be fully utilized.

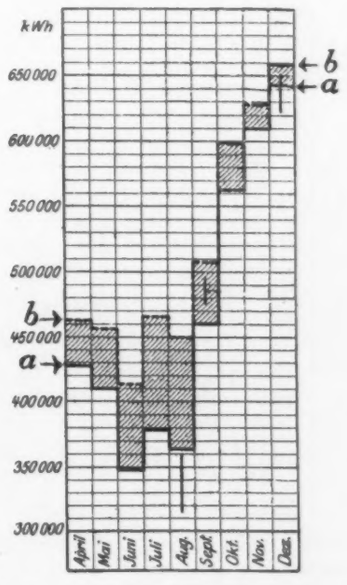



FIG. 2—LOAD CURVE FOR GERMAN ICE-MAKING PLANT

The author recommends that the distribution and sale of the ice to retail customers be leased to a delivery contractor, who would have to pay 11 cents per 100 lb. of ice. The profit to the central station amounts to 6.3 per cent on the invested capital, and since in making up the cost sheet a charge of 5 per cent interest on the

capital had already been made, the combined interest is 11.3 per cent. In addition, there is the profit for the sale of 220,500 kw.-hr. to the ice department at 1.5 cents per kilowatt-hour. This is figured out to amount to 5.5 per cent of the capital investment. The final total interest on the invested capital is therefore 16.8 per cent, which is considered very satisfactory. It should be added, however, that in making up the cost sheet the amount charged for "administration" is very small ($225, on the basis of 0.25 cent for 100 lb. of ice), as it is considered that the management of the central station would have very little extra work due to the ice plant.

---

### Generators, Motors and Transformers

*Single-Phase Commutator Motors.*—R. E. Hellmund and J. D. Dobson.—After discussing some fundamental principles of the single-phase commutator motor, the authors give a classification of such motors with pure stator excitation and a single cross-field winding and discuss the relative merits of the different types. The article is illustrated by numerous diagrams.—*Elec. Journal,* March, 1916.

### Lamps and Lighting

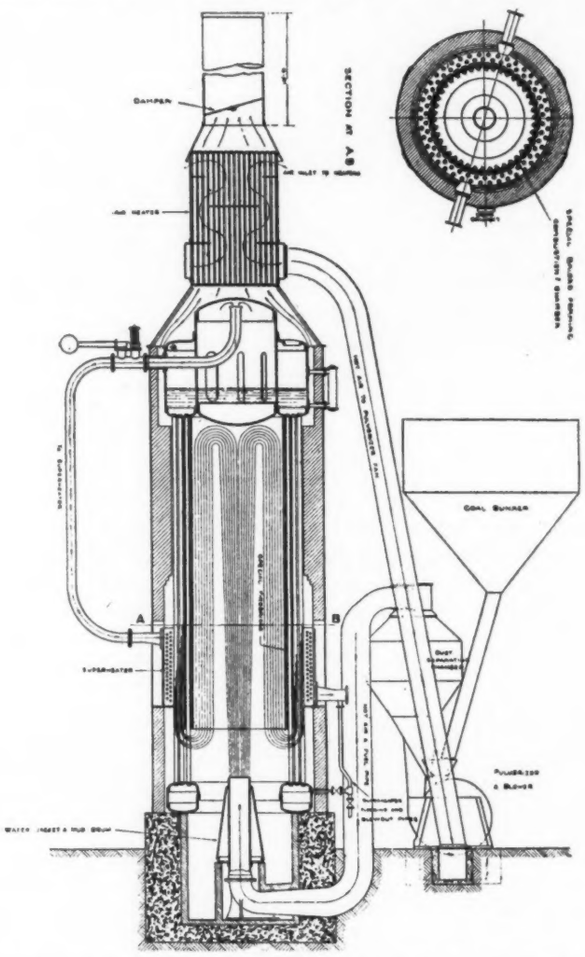
*Transformer Diagram.*—Ad. Thomaelen.—A mathematical article on the theory of the transformer diagram showing how the symbolic method of notation and the principle of inversion can be made use of to good advantage.—*Elek. Zeit.,* Jan. 13, 1916.

*Selecting Lamps.*—von Glinski.—In discussions as to whether arc lamps can still compete with tungsten incandescent lamps, the comparison is usually made between lamps of the same candlepower for both types. But the advantage that tungsten lamps permit the use of more lamps of smaller candle-power than is possible with arc lamps for the production of the same illumination is entirely lost sight of in this way. The author gives a method of calculation which should be followed in any case in which a certain illumination is specified, whether the specification requires that the minimum candle-power at any point should not be below a certain value or that the product of minimum candle-power and average candle-power should not be below a certain value. He gives simple formulas for determining in any case the most favorable candle-power of the lamp of each type; in a comparison of arc lamps and tungsten lamps the most favorable candle-power should be determined separately for each type of lamp.—*Elek. Zeit.,* Jan. 6, 1916.

*Tungsten Arc Lamps.*—A note on a recent British patent (No. 11,660, 1915) of the A. E. G. covering an arc lamp with tungsten electrodes inclosed in an inert gas in which the radiating surface of the pointed cathode is made so small that the temperature is higher than that of the anode, the auxiliary kindling cathode being made of similarly small dimensions.—London *Elec. Eng'ing,* Feb. 17, 1916.

### Generation, Transmission and Distribution

*Boiler for Powdered Coal.*—R. Turnbull Mawdesley.—In a continuation of an article on the municipal electric supply station of Johannesburg, in the Transvaal, a description of the boiler plant is given. There are sixteen boilers, of which fifteen are of usual types, while the sixteenth is a Bettington "atomized-fuel boiler" with superheater and economizer. This boiler is capable of evaporating 34,000 lb. of water per hour, at 180 lb. pressure, with feed-water at 85 deg. Fahr., and of superheating the steam 150 deg. Fahr. The broad principle consists in the use of a vertical "gas" (powdered coal) jet inlet so constructed that an umbrella-shaped flame is produced within a closed ring of vertical water tubes, which form the main heating surface of the steam-producing plant. The illustration shows a sectional elevation and cross-section of the Bettington boiler. The coal is powdered by two pulverizers situated directly in front of the boiler, one being driven by an alternating-current motor and the other by a direct-current motor. These pulverizers also act as blowers—and it has been found that one pulverizer is quite sufficient to supply fuel up to the normal output of the boiler. The air supply to the pulverizer is preheated by the escaping flue gases, and by this means coal of 15 per cent moisture is handled satisfactorily. From the pulverizer the coal passes to a separator, the larger and heavier particles returning to the pulverizer and the finer fuel passing direct to the tuyère, which is surrounded by a water jacket and forms a mud drum.



SECTIONAL ELEVATION AND CROSS-SECTION OF BOILER USED IN SOUTH AFRICAN MUNICIPAL STATION

The tubes surrounding the combustion chamber are lined with refractory material to within a short distance of the bottom header. No fireclay is used in lining this chamber, the firebricks being merely stacked in position. The ash of the fuel in its passage through the zone of highest temperature is converted into liquid spray, which quickly fills up the interstices, and the surplus in time trickles down to the bottom edge, from which it drips, in small globules, to the ash pit below. The result is that the furnace keeps itself quite clear of slag at all rates of combustion and deposits slag in a manageable form—*i.e.*, in globules about ½ in. in diameter—in the ash pit. The heating up and continuous ignition of the incoming stream of dust and air is effected primarily by the enveloping sheath of the products of

combustion—a mixture of gases ($CO_2$, $H_2O$ and N principally), at a temperature of about 3000 deg. Fahr. This "self-igniter" does not change in position more than 10 per cent, no matter how great a velocity is given to the incoming coarse "gas" (coaldust). The boiler is fired up when cold by means of a Bunsen coal-gas jet, which passes through the tuyère. This gas supply comes from the neighboring gas works. The pulverizer is run with the damper closed until a rich mixing is available, and then the full mixture is turned on. When this coarse "gas" is ignited the Bunsen flame is turned off and the fuel and air supply are regulated. It is possible to put this boiler on the range within twenty-five minutes of lighting up from dead cold. As soon as the fuel is shut off the fire is extinguished like a gas jet, and there are practically no stand-by losses.—London *Elec. Review*, Feb. 4, 1916.

## Installations, Systems and Appliances

*China.*—C. A. MIDDLETON SMITH.—An abstract of a paper read before the Hongkong local section of the (British) Institution of Electrical Engineers on electric generating stations in China. The number of Chinese who have any idea of what is meant by the words "electrical power station" cannot be one-tenth of 1 per cent of the population. Possibly about 10 per cent of the people have seen the ordinary electric lamp, and about one-tenth of that number have seen a gas lamp. In Hongkong there are two public electric-supply companies. There are also electric stations in Kowloon and Canton, but the great center of electrical development is Shanghai. The Shanghai generating station compares most favorably with anything of its kind in Europe or America. The station is steam-driven with two 5000-kw. and two 2000-kw. turbines. Quite recently the chief engineer has suggested extensions which amount to 20,000 kw. It is almost certain that this region will be the first part of China to develop works and factories on a large scale.—London *Elec. Review*, Feb. 4, 1916.

*Resistors.*—The first part of an illustrated description of several new designs of resistors built of metal wire or metal gauze. The article is to be continued.—*Elek. Anzeiger*, Jan. 23, 1916.

## Wires, Wiring and Conduits

*Zinc Wire.*—An official announcement of the German Association of Electrical Engineers on the use of zinc wire. This is now being introduced in Germany on account of the scarcity of copper and because iron wires are not always satisfactory. The comparative figures for copper, aluminum, zinc and iron are as follows:

| | Copper | Aluminum | Zinc | Iron |
|---|---|---|---|---|
| Specific resistance at 20 deg. C. in ohms per meter and square millimeter | 0.0178 | 0.0306 | 0.0625 | 0.143 |
| Conductance at 20 deg. C. in Siemens per meter and square millimeter | 56.2 | 32.7 | 16.0 | 7.0 |
| Conductivity in per cent of copper | 100. | 58.4 | 28.5 | 12.5 |
| Temperature coefficient per deg. C. | 0.004 | 0.004 | 0.0039 | 0.0057 |

Rules are given on the use of zinc wires in house installations and on the use of zinc cables and zinc busbars.—*Elek. Zeit.*, Dec. 9, 1915.

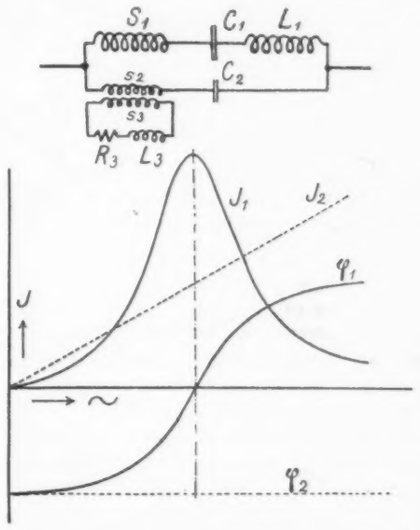
*Lead Cables.*—PAUL HUMANN.—Five tables giving the permissible load of lead cables with copper, aluminum, iron and zinc conductors.—*Elek Zeit.*, Dec. 16, 1915.

## Electrophysics and Magnetism

*Vibrations from Straight Conductors.*—J. A. POLLOCK.—To a first approximation, Abraham and other writers conclude from theoretical considerations that the wave-length of the disturbance in free ether due to the gravest electrical vibration on a thin, straight terminated conductor is equal to twice the length of the rod. This result is very definitely supported by Lord Rayleigh in opposition to the calculation of Macdonald, which makes the wave-length 2.53 times the length of the conductor. The author gives the results of experiments which completely support Lord Rayleigh's view and at least imply the experimental verification of his contention "that the difference between the half wave-length of the gravest vibration and the length of the rod (of uniform section) tends to vanish relatively when the section is reduced without limit."—*Philos. Magazine*, February, 1916.

## Units, Measurements and Instruments

*Indicating Frequency Meter.*—G. KEINATH.—In an article on recording instruments the author mentions a new indicating frequency meter of the dynamometer type for which an unusually high accuracy is claimed. As shown below, the stationary coil $S_1$ is connected in series with the condenser $C_1$ and inductance $L_1$, which are proportioned in such a way that resonance exists exactly at the mean value of frequency in the range of




ARRANGEMENT OF INDICATING FREQUENCY METER

frequencies to be measured. In the lower part of the illustration the current $J_1$ and the phase difference $\varphi_1$ between the current and voltage are plotted as functions of the frequency. The movable coil consists of two superimposed windings $s_2$ and $s_3$; one of these, $s_3$, is short-circuited over a resistance or inductance, while the other coil $s_2$ is in series with the condenser $C_2$ (or self-inductance) and connected across the line the frequency of which is to be determined. The leads of the movable coil have no directive force. The only directive force is due to the short-circuited coil $s_3$, which tends to place the movable system perpendicular to coil $S_1$. At mean frequency the torque is zero and the movable system $s_2$, $s_3$ is perpendicular to the coil $S_1$. At lower frequencies the torque is positive, at higher frequencies it is negative.—*Elek. Zeit.*, Dec. 15, 1915.

## Telegraphy, Telephony and Signals

*Microphones.*—P. O. PEDERSEN.—The conclusion of his illustrated paper on microphones and microphonic contacts. In the present installment the theory of microphonic carbon contacts is given. It is based on the following hypotheses: The product of contact resistance $R_1$ and contact area $a$ is independent of the contact pressure, $P$, provided the current $I$ through the

contact is small. The contact resistance $R_1$ depends on the current according to the formula

$$R_1 = \frac{s}{a} - \frac{bR_1I^2}{P^{3/5}},$$

where $s$ is the specific contact resistance for small currents and $b$ is a constant. The author gives the theory of the relation between contact resistance and pressure, the relation between resistance and size of grains, and the relation between resistance and strength of current. It is shown that his hypotheses are justified in so far as $b$ and $s$ are constants. Further progress in the study of microphonic action most come from an investigation of the physical nature of these two constants.—London *Electrician*, Feb. 4, 1916.

*Printing Telegraphy.*—H. H. HARRISON.—The conclusion of his long illustrated paper on the principles of modern printing telegraphy read before the (British) Institution of Electrical Engineers. An account of the extended discussion which followed is also given.—London *Electrician*, Feb. 11, 1916.

### Miscellaneous

*Electric Welding and Heating.*—In a continuation of the illustrated serial on electric welding different processes of resistance welding, spot and seam welding and electro-percussive welding are discussed. Reference is made to a peculiar "electrolytic welding process" which is used for special heating purposes. The Hohe electrolytic welding process is interesting, but not, so far as the writer is aware, of any great practical importance. The work to be heated is connected as cathode (or held in tongs with insulated handle) in an electrolytic vat which may have a special anode plate or be itself the anode. The electrolyte may be diluted sulphuric acid, a solution of sodium carbonate, a solution of borax and potassium carbonate, or a solution of sodium and potassium chlorides and carbonates. The only requirements are that it be a low-resistance electrolyte and yield hydrogen on electrolysis. The heating vat is connected in a 100-200-volt circuit, and the work rapidly becomes coated with a layer of gas bubbles, which offer such resistance that white heat is easily attained. The process is, however, only a heating process, and welding is supposed to be done on an anvil, so that the method is practically limited to wrought iron and mild steel. Obviously there is necessarily considerable loss of heat, to the detriment of efficiency. The most useful application of the method appears to be to annealing and tempering—either rods, tools or wire. The work is heated as above, and quenched simply by cutting off current altogether or, in the case of wire, by passing the latter beyond the current-carrying zone. While hot, the work is incased in a film of reducing gas, so that scaling and blistering is impossible.—London *Elec. Review*, Feb. 4, 1916.

*Conduction Through the Human Body.*—G. BUCKY.—With respect to the passage of an electrical current through the human body, the resistance of the different tissues and the complicated arrangement of the tissues with respect to each other are of great importance. The conditions are very complicated and the physician should understand them clearly if he wants to produce certain results. For the electrical engineer the subject is of interest as involving a full and detailed explanation of electrical accidents.—*Elek. Zeit.*, Dec. 23, 1915.

*Spain.*—Statistical tables giving the imports of electrical and similar goods into Spain during the years 1914 and 1913.—London *Elec. Review*, Feb. 4, 1916.

---

## Book Reviews

COLOR AND ITS APPLICATIONS. By M. Luckiesh. New York: D. Van Nostrand Company. 344 pages, 129 illus., 4 color plates. Price, $3.

Into the engaging fields of color and of color phenomena in vision Mr. Luckiesh's book lights new paths. The author is to be congratulated upon its complete and scientific treatment of its subject no less than upon the easy presentation and development of material necessarily complex. While the handling is such as to make the volume of perhaps greatest practical utility to the illuminating engineer—whose horizon is bound to be considerably broadened and his library enhanced by the possession of this work—its pages present an array of observations of phenomena, physical facts, data, etc., which will interest any scientific reader or student, and particularly the physicist. Considerations of theory and analysis of the pure physics and physiology of problems in light and color provide the groundwork of the subject, but the needs of the lighting practitioner are also satisfyingly met with an array of methods, experience data, formulas, curves and records, all ready for practical use. In addition to collecting and compiling the work of many other observers (to whom due credit is given) the author has set down many original data, observational results and conclusions, based upon his own researches with the unstinted facilities of an admirable laboratory. In view of the original work set forth, the chapters on the production of artificial daylight and the use of color in lighting interiors, canvases and specially prepared compositions will be read with particular interest. A clear boldface type and anti-glare paper stock make the book, moreover, a thing of comfort for night reading by lamplight.

WHEELER POST AND POLE CHART. Published by J. R. Wheeler, electrical engineer, Bellevue, Idaho. Price, 50 cents.

The author of this chart has arranged the basic facts pertaining to the decay of wood and methods of preventing it for convenient reference and use. The nature of decay of poles and posts is described and a brief summary given of preservatives and processes used in the United States to check the decay of wood. A process devised by the author for treating poles and posts with creosote and an asphalt is described in detail, giving the cost of applying the remedy. Revised official specifications of the Western Red Cedar Association for standard telegraph, telephone and electric-light poles are also included. The chart is 15 in. by 18 in., ready for mounting.

---

### Books Received

The Universe and the Atom. By Marion Erwin. New York: D. Van Nostrand Company. 314 pages, 58 illus. Price, $2.

Metal Statistics for 1916. Ninth annual edition. New York: The American Metal Market Company. 336 pages. Price, 50 cents.

The Authentic History of the United States Steel Corporation. By Arundel Cotter. New York: The Moody Magazine & Book Company. 232 pages, illus.

Oxy-Acetylene Welding and Cutting. Electric Forge and Thermit Welding. By Harold P. Manly. Chicago: Frederick J. Drake & Company. 216 pages, 56 illus. Price, $1.

Taschenbuch für Monteure Elektrischer Beleuchtungs Anlagen. By Von Gottlob Lux and Dr. C. Michalke. Munich and Berlin: R. Oldenbourg. 298 pages, 213 illus. Price, 3 marks.

J. B. OLSEN

**James B. Olsen,** who has been appointed general sales manager of the Habirshaw Electric Cable Company, New York City, formed recently by the consolidation of the Habirshaw Wire Company, the Electric Cable Company and the Waterbury Company, has been a well-known figure in the electrical wire and cable business for many years. He first entered this field in the sales department of the New York Insulated Wire Company, and for twenty years was a member of the sales organization of the Habirshaw Wire Company, having served the last eighteen years of this period as its sales manager.

**N. Kishi,** superintendent and electrical engineer of the Osaka Electric Light Company, Osaka, Japan, is now in the United States on a tour of inspection of central-station lighting properties.

**E. Thurnauer** of Paris, France, a well-known electrical engineer of France and the European representative of the General Electric Company, has been touring the United States since November and is now in the Pacific Northwest. As one of the officials of a big French electrical equipment company and managing director of the omnibus company which handles the traffic of Paris, M. Thurnauer has come in closer contact with the war than the average citizen and declares that one of the most interesting revelations of the struggle has been the adaptation of electricity and motor-driven vehicles to war uses.

**Samuel Insull,** president of the Commonwealth Edison Company of Chicago, at a dinner given for him at the Auditorium Hotel in that city March 3, received a diploma as an honorary fellow of the Royal Colonial Institute of London. This distinction, it is said, has been conferred only six times during the organization's fifty years of existence. The other recipients of the honor, who were all subjects of Great Britain, were Prince Christian, Field Marshal Lord Roberts, Joseph Chamberlain, Lord Curzon and the Duke of Connaught, Governor-General of Canada. Mr. Insull is the first citizen of the United States to receive an honorary fellowship in this body, which was organized to bring together the leading men of Britain and her possessions.

# *Men of the Industry*

Changes in Personnel and Position—Biographical Notes

**C. M. Brewer,** manager of the Western States Gas & Electric Company, Richmond, Cal., has been elected a director of the reorganized Chamber of Commerce of Richmond.

**A. E. Smith,** formerly assistant secretary and assistant treasurer of the Electric Bond & Share Company, has been elected treasurer and assistant secretary of the company.

**E. A. West,** who has been efficiency engineer of the Portland Railway, Light & Power Company at Portland, Ore., for several years, has accepted the position of chief engineer for the Denver Tramways Company. When F. W. Hild became vice-president and general manager of the latter company, Mr. West went to Denver to superintend a number of changes Mr. Hild desired to make and was at that time offered the position which he has just accepted.

**Richard H. Tillman,** who has just been appointed manager of the new-business and merchandise department of the Consolidated Gas, Electric Light & Power Company of Baltimore, Md., has been a member of the commercial department of that company since 1909, when he entered the organization as industrial engineer. In 1914 Mr. Tillman was appointed superintendent of power sales of the company, and in 1915 the commercial work of the industrial gas department of the company was also placed in his charge. Mr. Tillman is a graduate of the North Carolina College of Agriculture and Mechanical Arts at Raleigh, class of 1906. The two years after his graduation were spent in the testing department of the General Electric Company at Schenectady, and in 1908 he joined the engineering department of the Rochester (N. Y.) Railway & Light Company, being appointed associate engineer of the company in 1909.

R. H. TILLMAN

E. A. BARROWS

**Edwin A. Barrows,** who has just been elected president of the Narragansett Electric Lighting Company, Providence, R. I., succeeding Howard O. Sturges, who resigned because of ill health, was formerly vice-president, secretary and treasurer of the company. Mr. Barrows had previously served as secretary-treasurer for some years and in March, 1915, was elected also vice-president of the company, following Mr. Sturges' elevation to the presidency. Mr. Barrows will continue to devote his entire time to the executive management of the company, which has recently been undergoing remarkable expansion and growth.

**E. W. Hill,** formerly treasurer and assistant secretary of the Electric Bond & Share Company, has been elected a vice-president of the company.

## Obituary

**Henry W. Pope,** an early operator of electric-lighting plants in Brooklyn, N. Y., and a brother of Ralph W. Pope, honorary secretary of the A. I. E. E., died at Bellerose, L. I., Feb 29, at the age of sixty-eight years. Mr. Pope was a Civil War telegrapher and an old-time associate of Thomas A. Edison. For many years prior to his death he had been a member of the American Telephone & Telegraph Company's organization.

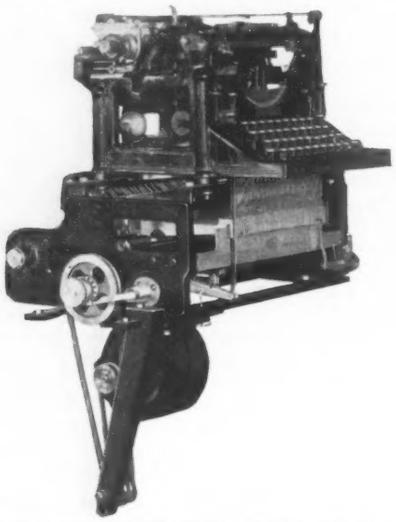
**Col. John C. Hooven,** president of the Hooven, Owens & Rentschler Company, engine builders, Hamilton, Ohio, and founder of the Dayton Rubber Company and the American Frog & Switch Company, died at his home in Hamilton, March 1, at the age of seventy-three. Colonel Hooven was a volunteer in the Ohio infantry during the Civil War. In 1882 in his plant, which had previously been devoted to the manufacture of threshing machines, he began the building of stationary engines, retaining from the first personal supervision over both the engineering and commercial work of his company, which during the thirty-four years since has constructed some of the largest steam and gas engines ever built. Colonel Hooven is survived by four sons, including C. E. Hooven, manager of the company.

# NEW APPARATUS AND APPLIANCES

*A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field*

## Automatic Motor-Driven Typewriter for Printing Form Letters

Form or circular letters written on the ordinary duplicating machines with the name, address and salutation "filled in" on the typewriter or from a nameplate seldom receive the attention from the recipient that a letter entirely written on the typewriter does. The difference in typing between the filled-in material and that printed on the duplicating machine is usually quite marked. Of course, in large business houses, where numbers of form letters are being sent out every day, it is next to impossible to have every letter individually typewritten in the ordinary hand-operated



MOTOR-DRIVEN TYPEWRITER THAT PRINTS LETTERS FROM PERFORATED SHEET

manner. The advent, therefore, of an automatic electrically driven machine which, as far as results are concerned, produces a letter that bears all the marks of one printed by hand, the fill-in details being taken care of by hand on the same machine, is particularly worthy of note and should be of first importance as an office appliance in every up-to-date business establishment.

In the accompanying illustration is shown a motor-driven typewriting machine the operation of which is automatic and is controlled by a perforated "master sheet." A 1/20-hp. motor is utilized to operate the automatic mechanism. The master sheets are prepared on what is called a perforating machine, which is equipped with an ordinary standard keyboard. The copy produced is not in type but in the form of perforations placed upon a roll of strong paper similar to the perforated rolls of the player-piano. A "master letter" can be made in about the same time as it would take to write a letter on a typewriter, and this master letter can, it is claimed, be used indefinitely. The complete equipment consists of a standard typewriter of any special style or type desired, an automatic operating device connected to the typewriter, the perforator mounted on a stand, and a six-drawer sanitary typewriter cabinet. The typewriter is so designed that it can also be operated by hand if desired.

When a record has been prepared on the perforator it is placed on the drum of the automatic typewriter in such a way that pins on the drum match marginal perforations on the record paper. Grooves are provided on the drum which run the full length from end to end, and the holes on the record come directly over these slots. Immediately above the drum there are fifty levers, in the end of each being a small pin which rests on the record paper and rides thereon when the drum is revolving. As soon as a hole comes under this pin in the lever, the pin drops through the hole into the slot in the drum, and as the drum is revolving, the lever is pushed lengthwise forward just in time for a moving part, called the rocker bar, to become engaged and tip up the end carrying the pin. The pin is removed from the slot and at the same time the end is tipped up and the other end is pulled down. The latter end, being connected by means of a hanger to the key levers of the typewriter, causes the type bar to be tripped and the letter to be printed. If any mistakes are made in cutting the record, they will show on the letter and can easily be corrected. The machine goes on writing until a stop or "motor-control" hole comes along, when it will automatically be stopped. This stop can take place anywhere desired; for instance, in the body of a letter a name, a sentence, a line or even a whole paragraph can be inserted by the operator using the keys of the typewriter and then pressing the motor-control button, when the machine will take up where it left off and finish the letter, stopping at the end. The operator then removes the finished letter, inserts another letterhead, puts on the date, address and salutation, and presses the motor-control button, the machine finishing the job and producing an actually typewritten letter. The machine writes from 100 to 120 words a minute.

The automatic typewriter is being made by the Hooven, Owens & Rentschler Company, Hamilton, Ohio.

## Rotary Check Valves Suitable for Pumps on Pressure Lines

A line of rotary check and suction valves varying in size from ⅛ in. to 24 in., said to be self-cleaning and self-grinding and well adapted for use in electric power stations, with centrifugal or turbine pumps, on pressure systems, etc., has been developed by the Smolensky Manufacturing Company, 932 Garfield Building, Cleveland, Ohio. The valves are designed to work under extreme pressures. When in operation the valve plugs revolve, and for that reason the valves are self-grinding. The manufacturer directs attention to the fact that the valves are of simple construction and light in weight. The seat of each valve has been made part of the pipe or casing, thereby eliminating the need of separate valve seats. Separate guides have also been done away with, and the valve itself is made in one piece. The valve is of skeleton form and is hollow or cup-shaped, having a closed bottom and ribbed openings on the sides through which the fluid flows. The seating edge of the valve is rounded, while the valve seat has a straight bevel, thus insuring, it is claimed, quick, accurate and tight closing under very slight pressure. The casing consists of a single casting having no cross-pieces. In the small sizes valves are made of pure Lake

copper. The intermediate sizes are provided with iron housings with valve seats of pure Lake copper, the valve proper being made entirely of this metal. The very large sizes, such as the 24-in. types, are equipped with iron

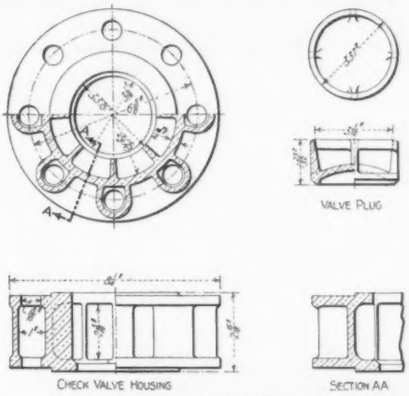



FIG. 1—CAST-BRONZE VALVE FOR 400-LB. WORKING PRESSURE

housings and valves of the same metal, but are provided with valve seats of pure Lake copper and renewable copper rings on the seat ends of the valves. On account of the comparatively small amount of back pressure required to close one of these valves, they will do efficient work at any angle, it is claimed, even with the valve seats upward in vertical connections. They also work satisfactorily in horizontal positions.

The pressure of the contents of the pipe always holds the plug in a central position, it is pointed out, with an equal space all around it, thus allowing a free passage to small particles of solid matter. This feature is also applicable to the suction valve. The suction valves are designed to do the work of two check valves, having both inlets and outlets. The suction valves are made up of three pieces, the casing and two plugs. No pressure is lost at the plugs of the suction valve, the manufacturer

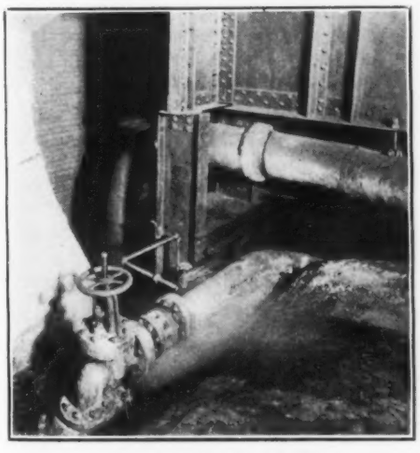
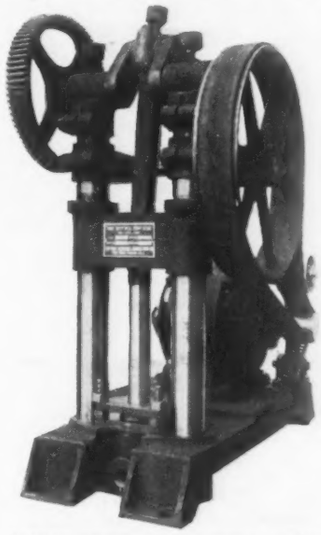


FIG. 2—250-LB. CHECK VALVE

claims, as they present a flat and even surface to the contents of the pipe. In Fig. 1 is shown a diagrammatic view of a cast-bronze check valve designed for a working pressure of 400 lb. In Fig. 2 is shown a valve designed for a steam pressure of 250 lb. which has been in operation for over four months in the power station of the Cleveland Electric Illuminating Company of Cleveland, Ohio.

## Electrically Operated Deep-Well Pump

The "Paul type H" deep-well pump, as it is called, illustrated herewith, has been developed for service where a simple and light pump is required. The outfit is mounted on a rigid cast-iron base as shown and is provided with two strong steel columns which act as a frame and guides. The main bearings as well as the bearings of the intermediate shaft are securely clamped onto these columns, permitting the gears to be accurately adjusted. The intermediate shaft carries a belt wheel at one end and at the opposite end a steel pinion meshing with the main gear at the end of the center crank shaft. The con-

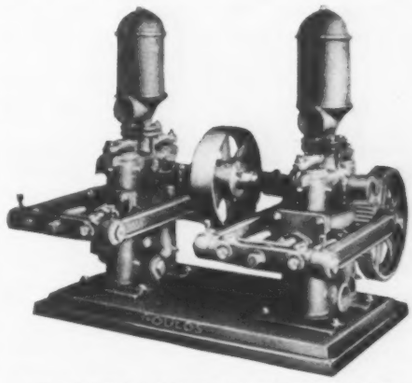


MOTOR-DRIVEN DEEP-WELL PUMP

necting rod is attached to a solid cross-head with large bearings guided upon the columns. The cross-head forms an oil pocket around the cross-head pin and has oil retainers at the columns, insuring ample lubrication, it is declared, with little attention. The differential plunger is threaded into the cross-head, passes through a packed stuffing box in the water head, and is tapped below for the sucker rod. The water head is bolted to the bedplate and is tapped for the drop pipe. By disconnecting the differential plunger the head can be removed without disassembling, leaving the water head and well parts free to be pulled up. The differential plunger equalizes the load and makes the pump double-acting, delivering an equal amount of water, it is asserted, on each stroke. A simple air compressor is operated directly from the cross-head, delivering air into the water head for charging pneumatic tanks. It is put out of action by opening a by-pass controlled by a thumbscrew. The outfit is being placed on the market by the Fort Wayne (Ind.) Engineering & Manufacturing Company.

## Pumping Outfit for Unloading Oil Tank Cars

At oil-tank stations where two or more different kinds of oils are stored outfits like the one illustrated are being

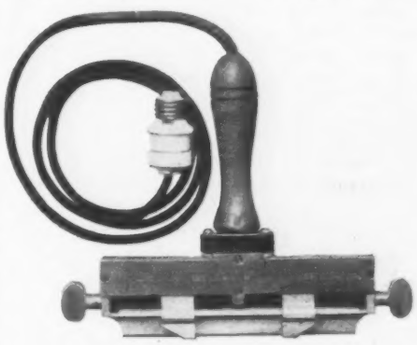


TWO PUMPS MOUNTED ON SINGLE BASE

used for transferring the oil from the tank cars to the storage tanks. The "1668" outfit, as it is called, which is made by the Goulds Manufacturing Company, Seneca Falls, N. Y., and is adapted for electric drive, consists of two 6-in. by 6-in. "pyramid" single-cylinder, single-acting piston pumps mounted on one base with a pulley between. The shafts of both pumps are fitted with jaw clutches so that the pumps may be operated separately or both at the same time. As it is not convenient always to clean the pumps, the outfit is said to be well adapted for such service, because a certain pump can always be used for handling the same oil.

## Electrically Heated Hand Pallet for Bookbinders

William H. Dalton & Company, 4 Charlotte Street, Salem, Mass., have developed an electrically heated tool which is designed to take the place of the hand pallets largely employed in the bookbinding trade and usually heated over a gas stove. The electrically heated pallet is advantageous, be-



ELECTRIC HAND PALLET

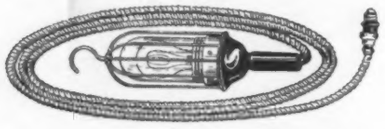
cause within a few minutes after the current has been turned on all the heat that is needed is produced and the temperature of the device can thereafter be maintained constant. Of course, with the electrically operated pallet no inter-

ruptions in the work are necessary for heating, as in the case with those pallets which are heated on a stove. The saving of time thus effected allows for a larger production within a given period. Furthermore, there is no dirt, as is the case when the pallet is heated on a gas stove. The type employed with the pallet can be easily and quickly changed, it is declared, a half turn of either one of the thumb screws shown in the illustration herewith releasing it, as the jaws work in opposite directions on a left-hand and right-hand screw. Being made for the most part of aluminum, the pallet is light and easy to handle. Special provision has been made to insulate the wooden handle thoroughly so that it is possible to operate the device continuously without any discomfort from heat. The energy consumption is small, only 110 watts being used. The device is designed to operate from an ordinary lighting socket and can be controlled by a small rheostat.

## Flexible Armored Cable and Vapor-Proof Fixture

"Steelite" cable is armored and is flexible, and carries No. 18 PWP cord, as it is called. The armor is formed from a steel ribbon having interlocking flanges, which give it a maximum of strength and flexibility, it is asserted. It is electro-galvanized to prevent rusting. The cable is said to be as flexible as a rope and light and easy to handle; it is also claimed that it will not kink or tangle. The outside diameter of the cable is 0.5 in., the tensile strength 160 lb. per square inch, and the weight 1.6 oz. per foot. It can be formed in a loop having an internal diameter of 1.375 in. When on the floor it will always lie flat, it is declared, and if hung from the ceiling will hang straight without kinks or curves. The armored cable is especially advantageous for drop and extension lamps, where it is desired to eliminate so far as possible the hazard of fire.

In the accompanying illustration is shown a type PVG2 vapor-proof fixture, as it is called, which is equipped with 25 ft. of "Steelite" cable. The fixture itself consists of a vapor-proof guard which is provided with a black-enameled wooden handle and metal guard with glass globe to protect the lamp and keep out explosive gases. The guard separates at the top for renewing the lamp. It takes a standard 50-



VAPOR-PROOF FIXTURE WITH ARMORED CABLE

watt carbon lamp or 40-watt tungsten lamp. At the handle end of the guard the cable is reinforced by an armor of the same construction as that of the cable which is slipped over it and sweated on at the end; thus the cable is strengthened at the point of greatest strain. At the attachment-plug end a brass bushing is sweated to the armor. The attachment-plug cap is screwed and cemented on and then filled with compound. After the fixture is completed it is tested with a 50,000-ohm generator for "grounds" and "shorts." The fixture is especially well adapted for use in oil refineries, gas plants, paint and varnish works, powder mills, arsenals, garages, or any place where explosives are present.

Another fixture of the same type as the vapor-proof fixture, except that it has an open guard, is designated as a type PPG device, and is designed for use in factories, warehouses, etc., or places not having explosive materials.

The "Steelite" fixtures, which include besides the above-named devices an extension for electric drills and tools and special drop fixtures, have been approved by the Underwriters' Laboratories, Inc. They are being manufactured by the Inland Electric Company, 14 North Franklin Street, Chicago, Ill.

## Reflector for Large Gas-Filled Units

The "Jumbo" reflector, as it is called, which is shown herewith, is designed for use with large nitrogen-filled incandescent lamps and is a recent addition

REFLECTOR FOR LARGE-SIZED HIGH-EFFICIENCY INCANDESCENT LAMPS

to the line of reflectors manufactured by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill. The unit has been designed particularly for the efficient illumination of large interiors of considerable height and floor area, such as erecting shops, armories, coliseums, etc. The reflector has been so shaped as to give the desired distribution of light and incidentally to conceal as much as possible the brilliant filament of the light source. The reflector is 16.5 in. in diameter and 13.375 in. high. It can be utilized with high-efficiency lamps with ratings of 500 watts, 750 watts, or 1000 watts. A special holder is provided for use with the reflector which has an adjustable feature, making it possible to obtain two or three degrees of spread to the light obtained from the unit. This reflector unit was first installed in the new armory of the University of Illinois, Urbana, Ill., which covers a ground area of 200 ft. by 400 ft. and is about 100 ft. high. Forty-two of these units are suspended 65 ft. to 85 ft. above the floor.

## Indicating Crane Signal

In large shops where cranes are continually moving back and forth workmen naturally waste considerable time watching in what direction the cranes are moving. To reduce this time

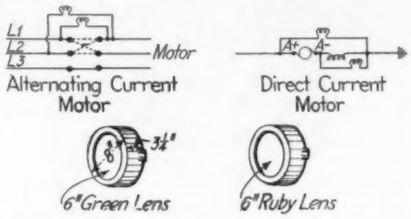



DIAGRAM OF CONNECTIONS FOR CRANE SIGNAL

wastage a signaling system for indicating whether the cranes are moving forward or backward has been developed. The outfit consists of red and green lanterns mounted on both sides of the crane, the lamps of which are connected to the motor circuits. The red lanterns of one side and the green of the other side are connected to the same circuit, with the system so designed that when the crane moves in one direction one set of lamps are automatically lighted, and when the motor runs in the other direction the other set of lanterns are lighted. Thus, when a person is in a certain position and the red lantern is lighted, it indicates that the crane is approaching him, and if the green lantern is lighted the crane is departing. When the crane is standing still no lights are shown. The number of lanterns employed are optional—three on a side for each color being generally used. These signaling lanterns are said to be valuable auxiliaries for warning gongs. Unfortunately, warning gongs attract attention but do not designate the direction in which the crane moves. When the cranes are equipped with the indicating signals, it only takes a glance to determine definitely whether the crane is approaching or departing, the workmen knowing instantly whether they are in danger or not. The indicating signals are said to be very useful to operators of neighboring cranes, minimizing the possibility of collision and enabling the operator to give practically all his attention to the floor level, since the signals come automatically within his vision with the approach of another crane, thus relieving him of strain and greatly increasing the general safety. The signaling device is being made by the Nichols-Lintern Company, Cleveland, Ohio.

## Steel Cabinets

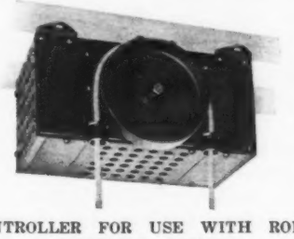
A line of steel cabinets designed particularly for use with Starrett panelboards has been developed by the Columbia Metal Box Company, 226 East 144th Street, New York. A cabinet has been brought out for each of the 258

CABINET MOUNTED IN STEEL BOX

different types of Starrett panels, the cabinets being made in five different styles. The panelboards and cabinets are so listed and receive such numbers that a contractor or jobber can easily obtain a cabinet for the corresponding panelboard, or vice versa. In the accompanying illustration is shown a No. 260 Starrett panel mounted in a No. 45SC Columbia cabinet.

## Intermittent-Duty Controllers

For use with rope-operated hoists, the Allen-Bradley Company, Milwaukee, Wis., now furnishes a universal intermittent-duty controller which is also well adapted for other service and can be arranged to be operated by a hand lever instead of a sheave and rope. Practically the same controller, it is claimed, can be utilized on any kind of alternating-current or direct-current motor within the rating of the device. Controllers of the type shown are light in weight and compact. The resistor and switch gear are mounted in the same frame, and the entire mechanism, including terminals and all live parts, is inclosed in a perforated-steel

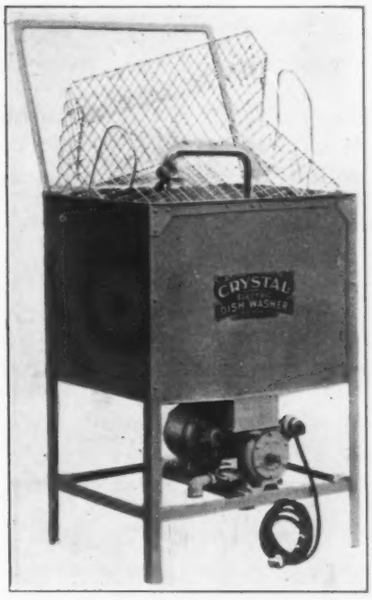


CONTROLLER FOR USE WITH ROPE-OPERATED HOISTS

case, affording protection and making the device entirely self-contained. Ball bearings are employed throughout to insure long life and smooth operation without the need of frequent lubrication. Use is made of a drum switch for switching operations. The resistor is of the graphite-compression type, giving a wide adjustment of speed control and making the device proof against moisture and fumes. An appreciable amount of speed control can be secured with these controllers when utilized with squirrel-cage motors, it is claimed; however, this control does not compare with that possible when slip-ring motors are utilized. The controller is being made in three sizes for use with 5-hp., 10-hp. and 15-hp. motors.

## Electrically Operated Dish-Washer

Drudgery as a necessary part of the housewife's tasks is being eliminated in increasing measure through the use of electric motors. Probably one of the most irksome of these tasks is the ever-recurring job of washing dishes, and the advent of any mechanical means for alleviating the dish-washing problem is sure of a welcome. In the accompanying illustration is shown a simple solidly constructed dish-washer equipped




MOTOR-DRIVEN DISH-WASHER

with electric motor, pump, cord, plug and switch and sewer connection. The dishes are placed in racks and the water is forced through and over them by means of the pump. The dishes do not move, and breakage is therefore declared to be impossible. After the first washing the dirty water is drawn out and hot, clean rinsing water is played on the dishes, rinsing and sterilizing them and leaving them so hot that when the washer is opened the dishes are dry and ready to be put away. The formerly disagreeable task is thereby completed without the operator even wetting her hands, yet with a great saving in time and with a large degree of safety for the glass and china. The machine is operated by a Westinghouse splash-proof motor and is being placed on the market by the Crystal Machine Company, Detroit, Mich.

## Equipment for Charging Starting, Lighting and Ignition Batteries

The line of charging apparatus placed on the market by the Cutler-Hammer Manufacturing Company, Milwaukee,

FIG. 1—SMALL RHEOSTAT FOR USE IN CHARGING AUTOMOBILE BATTERIES

Wis., for use with batteries on starting, lighting and ignition systems has recently been augmented by the addition of a new type of small rheostat such as is shown in Fig. 1, and by a larger one, developed particularly for charging a number of gasoline automobile batteries in series. The former is intended for mounting on a wall or switchboard, and consists of several resistance units inclosed in a sheet-iron case. On the slate panel there are several contact buttons with a convenient operating lever and the two binding posts at the top for connecting to the batteries. For this small rheostat, designated by the manufacturer as a type G device, two sizes are being made for connection to 115-volt direct-current circuits. The boxed weights are given as 16 lb. and 24 lb. respectively, and the maximum and minimum charging rates are given as 5 amp. and 2.5 amp., 10 amp. and 15 amp., based on charging the usual three cells of a 6-volt system in series. The rheostat shown in Fig. 2 is particularly well suited for the larger garages where it

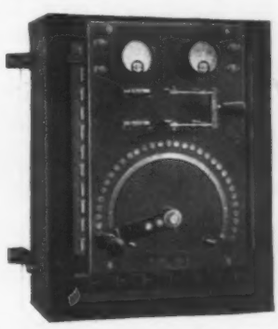


FIG. 2—RHEOSTAT USED WHEN CHARGING BATTERIES IN SERIES

is desirable and economical to charge a number of batteries in series. Rheostats of the type shown may be used to charge any number of cells up to 44 lead or 60 Edison on a 115-volt circuit, or up to 88 lead or 120 Edison cells on a

230-volt circuit. The apparatus consists of a sheet-metal frame arranged for wall mounting, containing the resistor and carrying a slate panel on which is mounted a movable arm with suitable contacts. Thirty steps of adjustment are provided. When required, a double-pole, main-line knife switch, an ammeter and a voltmeter can be furnished mounted on the panel as shown in the illustration. The voltmeter has a 15-volt scale, and is intended to be used with flexible leads so that the voltage of the separate batteries can be easily obtained.

## Ground Clamp

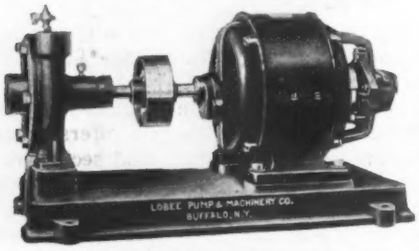
A ground clamp made of strong annealed copper, which is designed to fit snugly around any size of pipe or cable,

COPPER GROUND CLAMP

so as to insure good ground connection, has been placed on the market by Charles G. Robin, 48 Warren Street, New York. The clamp is easily adjustable and can be quickly installed. It is being made in three sizes, ⅜ in. to 1 in., ⅝ in. to 2 in. and ⅞ in. to 3 in. respectively.

## Electric Centrifugal Pump

In the accompanying illustration is shown a compact electrically operated centrifugal pumping outfit being manufactured by the Lobee Pump & Machinery Company of Buffalo, N. Y. The pump is fitted with bronze runners to resist the chemical action of the water, a 1.5-in. suction inlet and a 1-in. discharge outlet, and has a capacity of 25 gal. per minute against a head of 35 ft. When pumping against this head a 1-hp. motor is used. The pump is designed for heads up to 90 ft., but of course in such cases motors of correspondingly larger rating are required. The pump is well adapted for use on buildings where the pressure is low or for the circulation of brine in coolers, and for other purposes of a similar nature. The motor utilized to operate the set is of Westinghouse make.




COMPACT ELECTRIC-CENTRIFUGAL-PUMP OUTFIT

## Illuminated Porch Number

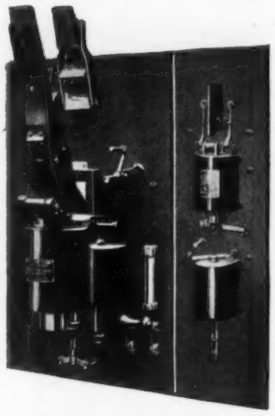
A simple device which may be readily attached to an ordinary porch lamp, at once converting it into a fixture which not only lights the veranda and steps but in addition shows in bright, clear-cut figures the number of the house, is being placed on the market by Stanley & Patterson, 23 Murray Street, New York. The desirability of showing the street number on a house at night is quite evident. The device illustrated herewith is particularly advantageous because of the fact that no special wiring is required. It can be installed in a few moments by anyone, all that is necessary being to remove the glass porch globe and to fasten the device on the porch ring by the same thumbscrews that held the globe. On the bottom of the "Whitlock" fixture, as it is called, is a shade holder, and the glass globe previously removed can be easily fastened to this holder. The figures are separate units, and numbers can be easily changed. Any house number of not more than five figures can be set in the device. The figures are over 2.5 in. high and are readily readable both day and night.

COMBINED PORCH NUMBER AND LAMP

## Feeder-Circuit Relay

The Automatic Reclosing Circuit Breaker Company of Columbus, Ohio, has recently produced a new relay, styled type F2, for use in conjunction with its automatic reclosing circuit-breakers. The standard form of automatic reclosing circuit-breaker made by this manufacturer is designed to control the entire energy input to the circuit and will not operate satisfactorily in a feeder circuit where the feeder is supplying energy to a load circuit which is also supplied by energy at other points. This new feeder circuit relay is designed especially to operate with circuit-breakers connected in a circuit supplying energy to a network of distribution. The accompanying cut shows the feeder-circuit relay operating in conjunction with a 1200-amp. type D automatic reclosing circuit-breaker, as it is called.

The outstanding feature of this relay, according to the manufacturer, is the provision for potential adjustment



AUTOMATIC RECLOSING CIRCUIT-BREAKER AND FEEDER-CIRCUIT RELAY

whereby the breaker may be set to reclose at any voltage from 50 per cent normal to full voltage on the load side of the breaker. Should the breaker open owing to an excessive load, the breaker will reclose at the expiration of a short time interval provided the voltage on the load side of the breaker is not excessively low; should the voltage be excessively low so that the breaker would immediately open were it to reclose, the potential adjustment could be set so that the breaker would not reclose until the voltage had risen to a safe value, but the instant the voltage does reach the allowable value the breaker will automatically reclose. Should a short-circuit occur the breaker would, of course, remain open until the short-circuit had been removed. Another feature of this relay is that it enables one to use the breaker on a network where a number of feeders are supplying energy to a common load, or it may be used on an independent circuit where breakers control the entire energy input to the load. When used in either connection the breaker will operate entirely automatically and will reclose only when line conditions are right and no short-circuit exists.

The dead-load adjustment is provided with the breaker whereby the breaker will reclose on any predetermined amount of load, such as with lamps, self-starting motors, etc., but will not reclose on actual short-circuits of low resistance. This combination of feeder-circuit relay and circuit-breaker is especially suitable, it is asserted, for the protection of rotary converters or generator sets in small substations supplying energy to mines, street railways, mills, etc., where the switchboard attendant has other duties to perform besides looking after the circuit-breakers. The potential adjustment on the relay provides a means of having the breaker closed only when proper voltage relations exist between the generator protected and the load circuit.

# NEWS OF THE INDUSTRY

*A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields*

## Supreme Court to Review Patent Case

The United States Supreme Court on Monday decided to review the right of a patent owner to fix the conditions and price of retail sale. The specific litigation is that of the Victor Talking Machine Company against R. H. Macy & Company over the right of the store to sell the machines and records at cut rates. R. H. Macy & Company lost in the court below.

In 1912 the court held that a patentee might make conditions as to the kind of supplies to be used on his machines. A year later the court decided that a patentee of a medicine compound could not prevent a drug store from selling his product to the public at cut rates.

Only seven judges participated in the first decision, and four dissented from the majority opinion in the second case. Several changes in the personnel of the bench have occurred since the first and even since the last decision.

## Delivery of Incandescent Lamps by Parcel Post

The Rochester (N. Y.) Railway & Light Company has been using the United States mails for the delivery of incandescent lamps since July 1, 1915. The results obtained have more than justified it. The cost of delivery per lamp by this method has shown a decided reduction over the old method of electric-auto delivery.

All orders received during the day are checked, packed, wrapped and delivered to the post office the same day for delivery the following day.

By using pre-canceled stamps all packages received at the post office before 9 a. m. are delivered that same day. The use of pre-canceled stamps also avoids unnecessary handling and pounding during cancellation and sorting by the postal clerks.

The type of men employed by the government in this service as a rule are far different from the usual delivery service drivers. The company has found them very careful, using good judgment and showing great pains in performing their work. In fact, the Rochester company says, the post office has co-operated with it in every possible way to insure prompt and safe delivery, going so far as to telephone the company regarding packages bearing insufficient addresses which the carriers were unable to locate, asking for further instructions, and making the necessary changes in address.

During a four months' period 26,000 incandescent lamps have been delivered by parcel post—about 70 per cent of this number being Mazdas.

The first month or two about twenty lamps were reported broken, which, upon investigation, showed carelessness in packing rather than handling by mail. Since that time the company reports having little or no breakage, and it is convinced that with the proper amount of care in packing the breakage will be nil.

During the Christmas holiday season, with the usual rush on in the post office, the company's reports show prompt delivery and no complaints from customers on failure to receive lamps. The only breakage reported was one lamp for this period, while during this time an average of 500 lamps a day were delivered.

The method of packing at present is to wrap the cartons as received from the lamp manufacturers in a single-backed corrugated cardboard for reinforcement and then wrap with the usual strong wrapping paper and tie with a stout twine. The company is now using a heavy corrugated carton of a predetermined size, which requires only tying with twine. It finds these cartons, at a cost of about 1½ cents each, to be cheaper and quicker than the time spent by a man cutting and fitting cardboard on each package or order.

Figuring the cost of cardboard, paper, twine, postage stamps and wages of man packing and wrapping, the company finds the delivery of lamps by parcel post to be about 0.012 cent per lamp.

The occasional emergency cases demanding immediate delivery are taken care of by special messenger or by the sign maintenance auto, but unless the call is urgent all lamps are delivered by parcel post the day after the order is received.

## Los Angeles Lighting Contract Anticipates Early Municipal Power

The Board of Public Works of Los Angeles on March 1 renewed the contract with the Los Angeles Gas & Electric Corporation for street lighting for a period of four months at the rate of $6.30 per month per lamp. The offer of the company to make the rate $5 per month per lamp instead of $6.30 if a three-year contract were signed was refused on the advice of the city's power bureau, which asserted that it is likely that the city's municipal lighting system, supplied by municipal power plants, will be in commission about the first of next year. It is estimated that the difference between the two rates for a period of three years amounts to about $175,000.

## Business Men in Northwest Check Attack on Light Company

That the general public may be changing its sentiment toward public-utility companies is shown in the recent efforts of the people of Lewiston, Idaho, and Clarkston, Wash., who were successful in persuading the Council of Lewiston to rescind its action instructing the city attorney to draw up a contract with a Spokane engineer to investigate the rates of the Lewiston-Clarkston Improvement Company.

For some time past various municipal officials in the Pacific Northwest have received attractive offers from engineers who guarantee to investigate and secure reductions of public-utility rates and to prepare evidence to submit to utility commissions. These offers are generally made on a contingent basis, and a number of communities have entered into contracts, the engineers to receive compensation only where the cases are successful. About the middle of February the Council of Lewiston instructed its attorney to draw up a contract with an engineer from Spokane.

On the night of Feb. 24 a large delegation of business men and orchardists from Lewiston, Clarkston and Asotin appeared before the Council and protested that the country could not develop without Eastern capital,

and that to subject established enterprises to the investigations of irresponsible engineers was foolish for communities that were pleading for further extensions of public utilities. The Council finally rescinded the motion and indefinitely postponed the whole investigation.

## Public Service Commission News

### California Commission

Can a municipally owned plant compete with a privately owned plant in another incorporated town? This is a question that will have to be decided by the Railroad Commission of California in connection with the complaint of the Pacific Light & Power Corporation against the city of Pasadena. The complaint asks that the commission direct Pasadena to obtain a certificate as a public utility to furnish electricity for light and power in South Pasadena, which is separately incorporated, and to file a schedule of rates to be collected from consumers in South Pasadena. The Pacific company also sells electricity in South Pasadena, and the company asserts that the city of Pasadena is engaged in active competition with it and has taken away many of its customers. It claims to be losing more than $3,500 a year by this competition.

### Vermont Commission

A decision has been handed down by the commission ordering the Burlington Traction Company to separate the line of poles of its high-tension line between Burlington and Ferrisburg to a minimum distance of 30 ft. from the line of poles of the Western Union Telegraph Company parallel thereto on the west side of the railroad track, or, as an alternative, cease from transmitting high-tension current over the eighteen sections involved after a certain date until such separation shall have been made.

In giving authorization to the Montpelier & Barre Light & Power Company to issue $300,000 bonds with which to purchase the Waterbury Light & Power Company, the Public Service Commission of Vermont took occasion to criticise the company's method of determining the value of the water rights of the Waterbury company as based on the annual saving of the water-power production of the company's two plants over the next best method of obtaining that power. The company figured the saving would, at 5 per cent interest, amount to a capitalization of $105,000. In this connection the commission expresses itself as follows: "The State introduced no evidence tending to dispute the accuracy of the computations above set forth, nor did it introduce evidence which in any way controverted or criticised the method used in arriving at this valuation of $105,000. The commission, however, entirely disapproves of this method of determining the value of these water rights, because in our opinion it creates a value which may be largely in excess of the actual value of the rights, and because this method, if applied to rates, would entirely deprive the consumer of any of the benefit to which he is entitled by reason of having these natural resources at hand. In other words, this method puts a consumer of energy generated by coal on a more even basis as to rates with a consumer using current from a hydroelectric plant, without regard to cost of production by the latter method. By this we do not mean that the producer should be deprived of all benefit accruing by reason of low cost of production of electricity by water-power, but we do mean that this benefit should inure to both the producer and the consumer in a question involving the fixing of rates."

The commission goes on to say that "no evidence was introduced by the petitioner or the State from which we are able to determine precisely what would be a fair valuation of these water rights, but from what we are able to determine from the case we must conclude that $300,000 is not an excessive valuation on all the properties, rights and franchises involved, and as this is the capitalization limit asked for by the petition, we are of the opinion that the petition must be granted."

### Ohio Commission

In granting the Scioto Valley Traction Company authority to take over the business of the Groveport Development Company, the Ohio Public Utilities Commission stipulated that the rates for service shall not be increased and that if the service is changed the company must bear any increased cost itself. It is said the company had intended the substitution of alternating for direct current.

### Iowa Commission

The Board of Railroad Commissioners of the State of Iowa has set March 16, at its office in Des Moines, for hearing and discussion of questions arising for its consideration and determination in hearings on applications for franchises to construct electric transmission lines, under the provisions of the law. The commission will hold hearings on the following subjects:

1. The various causes of substantial interference with the service of telephone and telegraph lines by high-tension transmission lines.
2. The various methods of preventing interference with telephone and telegraph lines by high-tension transmission lines, together with approximate cost.
3. The technical difference between induction and conduction.
4. Accepted standard of construction for electric transmission lines, (a) in cities and towns, (b) in rural districts outside of cities and towns.
5. Accepted standard of construction for telephone lines, (a) in cities and towns, (b) in rural districts.
6. Accepted standard of construction for telegraph lines.
7. Under what circumstances, if any, and, on what conditions, should overbuilding be permitted?
8. What methods should be adopted for safety of employees and public, as well as protection of electric lines against interference, where transmission lines and telephone or other electric lines cross each other?
9. In case of a paralleling of a telephone or telegraph line by a high-tension transmission line, what steps are necessary to be taken by either or both lines for the protection of employees and of the public and for the protection of the telephone and telegraph lines from interference by the transmission line?

In addition to the above-enumerated subjects, the commission will hear discussion of any other questions arising in the exercise of its jurisdiction. Immediately following the discussion of the questions in relation to the construction and operation of electric transmission lines, the commission will hear arguments of attorneys representing various interests affected on legal questions arising from the exercise of its power with particular reference to the following:

1. Does the prior occupancy of a highway by any telephone or other electric line give such company a superior right to the use of said highway such as to protect it against interference of a substantial character by a subsequent electric company of a similar or equal character, said subsequent company having no connection with public travel?
2. If the said interference can be substantially eliminated, at a reasonable expense, which company should bear the said expense?

**Climbing Roses for Electric-Light Poles.**—Following the lead of White Plains, N. J., the electric-light poles of Wallingford, Conn., will as far as possible be hidden this summer by climbing roses.

**Electric Lamps Burn for Thirteen Years.**—While refurnishing the City Opera House at Waterville, Me., several carbon-filament incandescent lamps were found still giving service. These lamps have been in use almost every evening for thirteen years.

**Sea Water Turned by Electrolysis Into Powerful Disinfectant on British Hospital Ship.**—While the process is not new, the British hospital ship Aquitania is using a powerful disinfectant made by the electrolysis of sea water. The disinfectant that is obtained is a solution containing sodium hypochlorite, or available chlorine.

**Little Rock Consumers May Get Certified Copy of Meter Reading.**—An ordinance to compel the Arkansas Water Company, the Little Rock Gas & Fuel Company and the electric department of the city to leave a certified copy of the meter reading with the consumer when the reading is made has been placed on the calendar of the Little Rock City Council.

**British Columbia Corporation May Develop Washington Water-Power Site.**—A notice has been filed by J. L. Fountain, Seattle, Wash., with the Snohomish County Commissioners at Everett appropriating 10,000 cu. ft. per second of water on the Sauk River for a hydroelectric development. It is reported that Mr. Fountain represents a British Columbia corporation which wishes to build a hydroelectric plant on the site.

**Kentucky Hydroelectric and Steam Companies Now on Equal Basis.**—Electric utility companies operating in Kentucky and generating by steam are put on an equal basis with hydroelectric companies in two bills which have passed the lower house of the Legislature. The more lately developed hydroelectric companies have enjoyed certain rights on the public roads besides the right of eminent domain, which the Legislature is now seeking to confer on the steam companies. Similar measures are before the upper house.

**Life Insurance for Employees of Westchester Lighting Company.**—All members of the employees' association of the Westchester Lighting Company are now automatically insured for $250 under a group policy, to which the company adds $100. Salaries will not be cut off during sickness, and the women working on an hourly basis are provided for by a sick benefit fund paying about 80 per cent of the employees' regular wages. Free company doctor's service and medicines are available for any member, and pensions are provided for disability after employees have served at least twenty-five years with the company and have reached an age of not less than fifty years. The employees make small weekly contributions, and the lighting company assists materially in making the project self-sustaining.

## *Current News and Notes*

**Timely items on electrical happenings throughout the world, together with brief notes of general interest.**

**Change to Eastern Time Decreases Detroit Lighting Earnings.**—The adoption of Eastern standard time by the city of Detroit in May, 1915, caused a loss of one hour per day of lighting to the Detroit Edison Company, materially affecting the earning from this source of business for 1915.

**Survey Ordered to Determine Cost of Building Municipal Plant for Phœnix, Ariz.**—The Phœnix City Commission has instructed the city engineer to make a survey and investigation with the view of determining the cost of constructing a municipal electric light and power plant. At present the city is being supplied by the plant of the Pacific Gas & Electric Company.

**To Promote Electric Cooking in Minneapolis with 2.5-Cent Rate.**—The Minneapolis General Electric Company has put in effect an electric-cooking rate of 2.5 cents per kilowatt-hour, less 5 per cent for prompt payment. The rate applies to all electric energy used in residences after the first 6 kw.-hr. per room per month, all energy used by the customer measured by the one meter.

**Minneapolis Contractors and Dealers Entertained.**—The Minneapolis (Minn.) General Electric Company on March 1 gave its fourth annual banquet to the electric contractors and dealers in its territory. The banquet and entertainment were pronounced the most successful of all the company has given. The program was decorated with a series of miniature photographs of the power plants of the Northern States Power Company, the parent company.

**Formation of Jovian Past-Tribunes' Association Suggested.**—Washington Devereux, past-tribune of the Philadelphia Jovian League, has suggested the formation of a Past-Tribunes' Association, either of local or national scope, and has invited present and past tribunes of his former jurisdiction to organize locally. In its tentative form Mr. Devereux's plan is to collect annual dues of $10 a member and make the last retiring tribune (in the case of the local organization) treasurer.

**Property Owners Benefited Must Pay for White Way at Sandusky.**—Through the action of the Ohio Supreme Court the city of Sandusky, Ohio, has succeeded in its attempt to assess the cost of the new "white-way" light system against the property owners who are directly benefited by the improvement instead of the citizens at large. This assessment in the business district is 50 cents per foot front. The decisions of the lower courts were both in favor of the city, and the Supreme Court refused to review a motion directing the Court of Appeals to certify its record.

**Practically All New Homes in Detroit Costing Over $1,200 Wired for Electricity.**—Practically every detached residence, every apartment house and every cottage costing more than $1,200 recently built in the territory served by the Detroit Edison Company is wired for electric light and is served by the company.

**American Gas Company to Erect Large New Steam Plant.**—Having purchased the Cedar Valley Electric Company, Charles City, Iowa, and connected it with the Citizens' Gas & Electric Company at Waterloo, Iowa, the American Gas Company now intends to take immediate steps to erect a large modern steam-electric plant at Waterloo.

**Will Appeal Test Case to Supreme Court.**—James M. Butler, who lost his injunction case to prevent the sale of energy by the municipal plant at Columbus, Ohio, to private industrial concerns, will appeal to the Supreme Court from the decision of the Common Pleas Court. He contends that energy is sold below cost and that favor is shown to certain corporations.

**Electric Company's Reception and Waiting Room Popular.**—In the plans for the extension to its general offices the Minneapolis General Electric Company has provided for an enlargement to the waiting and rest room which was established for the use and convenience of its customers. General Manager Pack says: "The reception and waiting room feature has grown so popular that it is necessary to increase the size of the room and add more easy chairs to accommodate the many shoppers who rest there."

**Cost of Energy Production in Massachusetts Municipal Plants.**—The operating expenses of the thirty-five Massachusetts municipal plants for the year ended June 30, 1914, were $858,435, or 2.5 cents per kilowatt-hour of output. Interest and depreciation brought the total expense up to $1,063,242, making the total cost per kilowatt-hour of output 3.1 cents. The total output both generated and purchased was 34,286,029 kw.-hr., of which 4,700,000-kw.-hr., or 13.7 per cent, was purchased.

**Samuel Insull Addresses Cleveland Advertising Club and Cleveland Electrical League.**—Members of the Cleveland Advertising Club and Cleveland Electrical League gathered in the ballroom of the Hotel Statler on March 1 and heard an interesting talk by Samuel Insull, president of the Commonwealth Edison Company. This was the thirty-fifth anniversary of Mr. Insull's first day as private secretary to Thomas A. Edison, and his talk turned to the great things that have been accomplished electrically. He said the electrical system at Menlo Park, March 1, 1881, was in every essential the same as the best to-day. The steam turbine, said Mr. Insull, has made possible 45,000 hp. on one shaft, and soon we may expect 80,000 hp. to 100,000 hp. Centralization of power distribution, he said, is the real conservation of our natural resources.

**To Produce Rain Electrically.**—The New South Wales patent of J. G. Balsillie for producing rain has been investigated by a scientific committee, of which Professor David of Sydney is chairman, and the report has been presented to the Premier of New South Wales. The committee reported that it had come to the conclusion that Mr. Balsillie had not succeeded in making any definite advance in the direction of obtaining practical results in the production of rain by electrical means, although his combination of an electrically charged body and Roentgen rays improved the prospects of success.

**Salary Dividends for Employees Announced.**—The United Electric Light & Water Company, Waterbury, Conn., has announced the adoption of a "salary dividend" and "welfare plan" for all of its employees who have been in its service for a year or more. For this purpose the company intends to put aside at every quarter 5 per cent of its net income before paying dividends. One-half of the amount set aside for salary dividend and welfare fund will be distributed in cash, quarterly, the other half to be put in a welfare fund and held by a board of managers for the benefit of the employees. The first distribution will be made in April for the quarter ending March 31, 1916.

**Another "Mosquito Case" Won by Power Company.**—Another case in which damages were claimed as a result of malaria caused by mosquitoes said to have been bred by water which overflowed the banks of the Coosa River has been won by the Alabama Power Company by the action of the Chilton Circuit Court in dismissing the case of J. M. Duke against the company. Expert sanitary testimony was to the effect that the illness was caused by filthy yards and outhouses surrounding the homes of the complainants. Some 1000 of these cases, all identical, are pending in the courts of Talladega, Chilton and Shelby counties. In every case so far decided the power company has won.

**Suggests That Candidates for Indiana Legislature State Stand on Proposed Utility Amendment.**—It has been suggested that all candidates for the Indiana Legislature be asked to state how they stand in regard to the proposed changes in the public-service law designed to minimize any tendency on the part of public-utility corporations to over-capitalize. Each candidate, it is suggested, should be asked to answer the two following questions: First, "Do you favor amending the public-service law in such a way as will require the Public Service Commission to appraise all physical properties of any corporation before authorizing an issue of stock and bonds?" Second, "Would you favor an amendment, and do all in your power to get it enacted, empowering the Public Service Commission to declare a corporation insolvent where it is found that its outstanding liabilities exceed the value of its physical and tangible properties necessary to supply such utility as they may be serving?"

**Cleveland Electric Illuminating Company Successful in Its Unique Collection for Charitable Purposes.**—Charles W. Mills, treasurer of the Cleveland Electric Illuminating Company, made a report on March 2 to Secretary C. W. Williams of the Cleveland Federation for Charity and Philanthropy showing that within the past two months $259 had been collected from 237 persons through a plan described in the ELECTRICAL WORLD some time ago.

**Claims Filed on Oregon Water-Powers.**—In a news article under the above caption appearing in the ELECTRICAL WORLD for Feb. 12 the license rates are erroneously given. The correct rates are as follows: For the first 100 theoretical horsepower, 10 cents each; for the next 900 theoretical horsepower, 5 cents each, and all in excess of 1000 theoretical horsepower, 1 cent each. No fee is required of State, federal or municipal plants or those rated at less than 25 theoretical horsepower.

**Madisonville (Ohio) Municipal Plant to Be Abandoned.**—With the consent of Mayor George Puchta of Cincinnati, steps will soon be taken by the City Council to dispose of the municipal plant in Madisonville, now a part of the city of Cincinnati. It is said the plant has been a losing venture from the start and has not been able to meet competition. With the number of important improvements in progress and the rather stringent financial condition of the city, the officials do not want to be hampered with a losing proposition.

**Leakage of Current from Electric Railways.**—As the result of a study of the problems connected with the leakage of current from electric railways the Bureau of Standards, Department of Commerce, has just published Technologic Paper No. 63, dealing with this subject. The theory of the leakage of current from electric-railway tracks is developed mathematically, and curves are then plotted to aid in the interpretation of the results. The conclusions to be drawn from the formulas and curves are discussed with special reference to practical problems in electrolysis. The paper is intended primarily for electric-railway engineers and others familiar with electrolysis problems.

**Rail Joints and Bonds.**—"Modern Practice in the Construction and Maintenance of Rail Joints and Bonds in Electric Railways" is the title of Technologic Paper No. 62, just issued by the Bureau of Standards, Department of Commerce. The paper is largely a compilation of information in the nature of data and opinions submitted by forty-two electric-railway companies that answered inquiries sent out by the bureau. Analysis of the data shows that soldered bonds have been demonstrated to be unsuccessful and are now practically obsolete, while all other types of standard bonds are capable of giving good results, but only when carefully installed. The adoption of various types of welded joints to take the place of the common bolted joint appears to be in progress in most of the larger cities. The whole problem of track bonding is shown to be in a state of evolution.

**World's Salesmanship Congress.**—The world's salesmanship congress will be held from July 9 to July 13 in Detroit. This is the first of a series of annual conventions of salesmen and executives in every line of business activity, and every country in the world will be represented in the congress. The congress is the outgrowth of the Salesmanship Club of Detroit.

**Kansas City Utility's Library for Employees Meets with Favor.**—From a small beginning four years ago the working library installed in the offices of the Kansas City Light & Power Company for the benefit of employees has grown until it now contains, in addition to the current issues of the trade papers, 290 reference and text books, 67 government publications, 126 manufacturers' publications and 98 bound volumes of trade publications. In 1915 there were 128 active users of the library, to whom were issued for outside use 476 books. In addition, the men are allowed the free use of the library at all times.

**Development of Ontario Hydroelectric Power Before Provincial Legislature.**—The authorizing of the Beck Niagara power development scheme is one of the main features of the Ontario government's program for the second session of the fourteenth Legislature of Ontario. In the Lieutenant-Governor's speech at the opening of the House on Feb. 29 the government's policy regarding this question was well defined. For many months Sir Adam Beck has been urging on the government the necessity of spending some $14,000,000 on an overland canal from Chippewa Creek to the escarpment at Brock's Monument at Queenstown, which would turn a volume of water into the lower river, capable of developing 600,000 hp.

**English Central-Station Statistics.**—Statistics published in the *Electrical Times* give financial and operating data for 319 plants for a twelve-month period in 1912-13 and for 323 plants for a similar period in 1913-14. The revenue from the sale of energy in the first period was $45,603,055, and in the latter period $49,608,300. The working expenses for the two periods were $23,565,440 and $26,123,755 respectively. In 1912-13 the gross profit per $100 capital was $7.11, and in the succeeding year it was $7.29. In the first period $2.78 was provided for depreciation and sinking fund per $100 capital, and in the latter period $2.81. The net profit per $100 capital in the earlier twelve months was $4.38, and in the succeeding year $4.48. In 1912-13 there was sold 1,294,384,809 kw.-hr. at an average price of 3.38 cents. The working expense per kilowatt-hour was 1.74 cents. The output in 1913-14 was 1,478,670,322 kw.-hr., at an average price of 3.32 cents and an average cost of 1.70 cents per kilowatt-hour. The rating of the 319 plants in 1912-13 was 1,060,066 kw., and they had a maximum load of 702,904 kw., with an average load-factor of 21.02 per cent. The rating of the 323 plants in 1913-14 was 1,185,209 kw., the maximum load was 780,418 kw., and the average load-factor was 21.63 per cent.

**Milwaukee Jovian League.**—A rejuvenation is planned by the Jovian League of Milwaukee for March 17.

**Detroit Engineering Society.**—Prof. D. C. Jackson of the Massachusetts Institute of Technology will talk on "High-Power Traction" before the Detroit Engineering Society on Friday evening, April 7.

**National Electric Piano Makers.**—It is announced by the National Electric Piano Makers that it has been decided to postpone until the coming autumn the "Electric-Piano Week" campaign originally intended for the week of March 13 to 18.

**Missouri Association to Hold Convention Aboard Boat.**—The executive committee of the Missouri Association of Public Utilities has decided that the 1916 convention shall be held May 11, 12 and 13 aboard a boat leaving St. Louis, traversing the Mississippi and Illinois Rivers to a point above Peoria, Ill., and returning to St. Louis at the end of the third day. F. D. Beardslee of St. Louis is secretary and treasurer of the association.

**N. E. L. A. Committees Meet.**—Five important committees of the National Electric Light Association were scheduled to meet this week at the Engineering Societies Building, New York City. The public-policy committee and the committee on transportation met on Wednesday, the committee on terminology on Thursday, and on Friday the committees on electrification of steam railroads and on the form of annual reports for central stations.

**Ithaca Section, A. I. E. E.**—The annual banquet of the Ithaca Section of the American Institute of Electrical Engineers will be held in the dining-hall of the Home Economics Building, Cornell University, March 25. Among the speakers scheduled are J. J. Carty, president of the A. I. E. E. and chief engineer of the American Telephone & Telegraph Company; Dean Graham of the Smith School of Applied Science, Syracuse University, and Prof. Alexander Gray, head of the department of electrical engineering of Cornell University.

**Connecticut Get Together Club, N. E. L. A.**—Members of the Connecticut Get Together Club of the National Electric Light Association, composed of central-office men, contractors, jobbers and, in fact, all persons interested in the electric trade in Connecticut, gathered at the Hotel Bond on Feb. 25 for the semi-annual meeting. The chief speaker was F. J. Lyon, superintendent of the Waterbury division of the United Electric Light & Power Company, who took as his subject "Concentric Wiring." Other speakers were Prof. Charles F. Scott of the Sheffield Scientific School, Samuel Ferguson, vice-president of the Hartford Electric Light Company, and G. B. Leland, superintendent of the Stamford Gas & Electric Company.

**Los Angeles Jovian League.**—The regular weekly luncheon of the Jovian Electric League, Los Angeles, was held on Feb. 23. Warren C. Kennedy, secretary of the Baker Iron Works, who was formerly president of the Los Angeles Credit Men's Association, spoke on "Credits." He said in part: "A proper understanding of credit carries with it need of being posted on collateral subjects such as commercial law, costs of doing business, general financial and banking problems, accounting, cost-keeping, fire, life, compensation, credit and marine insurance, experience in buying and selling, advertising, efficiency, legislation and taxation. A rejuvenation was held on Feb. 18, at which forty-five candidates were initiated.

## *Associations and Societies*

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

**University of Kansas Branch, A. I. E. E.**—The University of Kansas branch of the American Institute of Electrical Engineers at Lawrence, Kan., followed the subjoined program at its March 1 meeting: "Modern Tendencies in Heat Power Engineering," by Prof. F. H. Sibley, Lawrence, Kan.; "Rates and Rate Making," by W. J. Norton, Chicago; "The Manufacture of Carbon Products and Dry Cells," by Carl Hambuechen, St. Louis; "Power-Plant Tests," by Rea Putnam, Lawrence, Kan.; "Modern Tendencies in Motor Design," by Prof. A. C. Lanier, Columbia; "Back to the Farm" (motion pictures), by R. I. Parker, Schenectady; "The Social Status of the Engineer," by Prof. C. E. Reid, Manhattan; "The Use of Electricity in the Oil Fields," by W. F. Barnes, Kansas City, and "Human Interests and the Manufacture of Electrical Apparatus" (motion pictures), courtesy of C. R. Dooley, Pittsburgh.

**Industrial Lighting Committee, Lighting Sales Bureau, N. E. L. A.**—The committee on industrial and yard lighting of the new Lighting Sales Bureau, Commercial Section, N. E. L. A., has announced through Oliver R. Hogue, secretary of the Lighting Sales Bureau and chairman of the committee, the outline of its part of the Lighting Sales Bureau's report at the 1916 N. E. L. A. convention. The outline was prepared by Mr. Hogue with the assistance of members of his committee. The part of the report devoted to industrial lighting will consist of eight sections, as follows: (1) Preface; (2) methods used to obtain industrial load; (3) designs of industrial lighting systems; (4) data on typical installations; (5) arguments for good lighting; (6) load-factors; (7) maintenance; (8) color value. The section devoted to installation will include views of installations in typical plants of thirty industries.

**New-Business Co-operations Committee, Ohio Electric Light Association.**—The program for the next meeting of the new-business co-operations committee of the Ohio Electric Light Association, which is to be held at Springfield, Ohio, March 15, has been arranged as follows: Address of welcome, Weare Parsons, general manager Springfield Light, Heat & Power Company; "The Golden Rule in the Utility Business," E. Burt Fenton, publicity manager W. S. Barstow & Company, New York City; "The Value of Residential Business to the Central-Station Company," G. A. Lowther, Sandusky Gas & Electric Company; "Results Obtained from Kitchen Service Installations," T. F. Kelly, commercial manager Dayton Power & Light Company; "Salesmanship," F. B. Hutchinson, sales manager Kelly-Springfield Motor Truck Company, Springfield, Ohio; "Electric Industrial Trucks," C. E. Ogden, Walker Vehicle Company, Cincinnati; "Solving the Heating Problem and Securing the Power Business," A. C. Shepherd, Cleveland Electric Illuminating Company. Following the close of the afternoon meeting, the delegates will visit the factory of the Robbins & Myers Company.

**Wisconsin Electrical Association.**—The Wisconsin Electrical Association's annual convention, previously announced, will be held in the club room of the Hotel Pfister, Milwaukee, on March 16 and 17. On March 16 there will be a joint session with the Wisconsin Gas Association. The following is a list of subjects on which papers will be presented: "The Attitude of the Wisconsin Railroad Commission on Security Issues," by Harold L. Geisse, stock and bond expert of the Railroad Commission of Wisconsin; "A Review of State Legislation During the Past Session," by John B. Sanborn of Sanborn & Blake, Madison, Wis.; "Methods of Taxation of Public Service Companies in Wisconsin and Why Taxes Have Been Increasing Annually," by T. E. Lyons of the Wisconsin Tax Commission; "Outdoor Substations," by H. W. Young, president of the Delta Star Electric Company, Chicago; "Rates for Residence Electric Service," by A. C. Babson, manager of the Wisconsin Gas & Electric Company, Watertown, Wis.; "Street-Lighting Rates and Contracts," by G. W. Van Derzee, assistant to the vice-president of the Milwaukee Electric Railway & Light Company; "Two Years' Experience with One-Man Car Operation," by R. M. Howard, manager of the Wisconsin Railway, Light & Power Company, Winona, Minn., and "The Telephone Company and the Electric Utility," by S. O. Seymour, general manager of the Wisconsin Telephone Company, Milwaukee. S. B. Way, vice-president and general manager of the Milwaukee Electric Railway & Light Company, in conjunction with the Wisconsin Electrical Association's committee on overhead distribution, will discuss the subject "The National Electrical Safety Code." Another subject scheduled for discussion is "Automatic Current-Limiting Circuit-Breaking for the Protection of Railway Feeders and Rotary Converters." A banquet will be held on March 16, and speakers of national reputation, among them Lou J. Beauchamp, Chautauqua lecturer, will be present.

# FINANCE, COMMERCE AND INDUSTRY

*News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods*

## Manufacturing and Industrial

### Glassware Manufacturers Busy

The buying of electric-fixture glassware at present is brisk. For some time now the demand, it was stated by prominent manufacturers, has been large, and quite a few companies find themselves in the position of receiving orders faster than goods are delivered. This has resulted in not a few cases in a congestion at the factory.

Upon the United States has fallen the task of supplying with glassware the markets of the world that are now open. Both the domestic and the foreign buying of this material are large. Prior to the war, the outbreak of which caused a serious upheaval in the glassware trade, the principal competition with American glassware manufacturers came from Austrian, German, Belgian and Dutch manufacturers and to a certain degree from those of France. The war practically stopped the shipment of goods from these countries and called the workmen to the colors.

The markets of the world, therefore, that are now buying and that formerly were supplied from these European sources have begun to turn to the only dependable source at present, namely, the United States. South America, Central America, the British Isles, Australia, Venezuela, New Zealand and Africa are now buying glassware for electric fixtures from American manufacturers in rather large quantities. It is significant that before the commerce of the world was interrupted by the war American manufacturers supplied these markets with but little material. While America could always compete with Europe in quality of glassware it was not so easy to compete on prices because of the wages paid to American labor in comparison with wages in Europe for similar work. Besides this, the system of extending credits worked so successfully by European merchants was a handicap to the American exporter.

The manufacturers report that there is no difficulty in getting export orders, and some manufacturers are even discouraging them because of the large domestic demand. As to what will happen when the war is over, however, none would venture an opinion. Still, there was a note of fear that the advancing price of American labor might overweigh any advantage or foothold now being gained as soon as Europe shall be again able to export glassware.

In the domestic market it was felt that the volume of buying was large for many reasons. Principal among them were the following: The stoppage of the European supply, which has turned buyers of foreign-made goods to those of domestic manufacture; the increased industrial activity, which is calling for more glassware to aid better illumination; the natural advance of the trade, and the financial prosperity of the times.

Not only have prices already advanced but they are expected to advance still further. The prices of raw materials are the principal reason for this. Chemicals, especially lead and potash, besides being extremely hard to obtain, are very much higher than they were a year and a half ago.

Deliveries are being made as quickly as possible, although they are for the most part considerably delayed. The condition of the raw-materials market is, of course, the most serious situation in this respect. Some factories are experiencing trouble in getting labor, and all of those depending on natural-gas fuel have, of course, suffered from fuel shortage that always comes with cold weather. This latter condition, however, it is expected, will not occur again until next winter. The freight congestion has caused particular hardship to a number of companies. Frequently export orders have been held up indefinitely, and the freight tie-up has in many cases caused a delay in deliveries that otherwise would have been exceptionally good.

### Russian Trade Possibilities Excellent for Electrical Goods

Marcus Stowe Hill, recently returned from a seven months' stay in Europe as the representative of eighteen large Middle West manufacturers, reports excellent trade possibilities for electrical goods in Russia. The markets of the country, he said, are absolutely bare. The merchants are hungry for American goods, and American consuls are flooded with inquiries as to where all kinds of manufactured articles can be purchased. Orders for great quantities of telephone and telegraph apparatus and for tons of wire are awaiting American manufacturers. There is an exceptionally strong demand for small motors from ⅛ hp. to 4 hp. Electrical equipment for demonstrating purposes in schools, X-ray apparatus, batteries and absolutely all kinds of electrical supplies are wanted in large quantities. Mr. Hill said that when he left Petrograd there was not a dry cell in the city to be purchased, and he repeats that the market shelves are practically bare of everything.

Between 125,000 and 150,000 resident German merchants and manufacturers have been sent to Siberia, and the Russians are anxious that Americans should take their place. They are offering to provide three-fifths of the required capital investment if Americans will furnish the other two-fifths and the brains to establish American manufacturing plants in Russia.

Mr. Hill has been working in Russia on a basis of sales direct from manufacturers to dealers, eliminating the commission system, under which Russia has been greatly handicapped. In the purchase of manufactured articles at the present time it is not so much a matter of price as it is one of getting the goods, for the prices being quoted by American manufacturers, while very substantial, are nevertheless considerably under what the German merchants, acting as jobbers in Russia, have heretofore charged for the same articles.

The Russian credit, Mr. Hill said, is not only unquestionable but there is a great abundance of ready cash in the country, more so at this time than ever before. This is on account of the fact that the use of vodka has been abolished. Up to the last of December, and since the abolishment of vodka, the bank deposits increased over 1100 per cent, according to government report.

American manufacturers have, he stated, a great advantage over British manufacturers in shipping goods to Russia in that the latter must make application to the War Office for permission to export. At the least, it is three months before they get a decision, and permission may then not be granted. American manufacturers thus receive a tremendous advantage on time of delivery, which is one of the very important considerations under present conditions. The Russians are prepared to pay the price because of the shipping difficulties, and they will furnish bankers' irrevocable confirmed credits with each order.

Any firm contemplating granting a sole agency to a Russian is warned by Mr. Hill to investigate the standing of the individual very closely before so doing to determine whether he intends to use this agency or to sell it. He says that a great many sole agencies are passed around from one man to another, none of whom knows anything about the business involved or cares to do so, since he only intends to sell the agency for $2,000 or $3,000 to the next man. Mr. Hill urges that no agency be granted until the reliability of the proposed agent has been positively established.

Another caution is that any correspondence or article sent by mail to Russia should be registered, as such mail is more quickly censored and is more apt to get past the censors and also provides a means of tracing more readily. Mr. Hill's address is 1455 Carmen Avenue, Chicago.

**The Hygrade Lamp Company** has moved from Danvers, Mass., to Salem, Mass. This company was formerly known as the Hygrade Incandescent Lamp Company.

**The National Electric Utilities Corporation** has opened a New York office at 103 Park Avenue, where it is also maintaining a display room. E. C. Van Glahn is president of the concern.

**M. A. Shadley,** formerly superintendent for the Squire Electric & Construction Company, Kansas City, Mo., has opened offices for electrical contracting at 704 Wyandotte Street, Kansas City.

**The Rubes Electric Devices Company,** 220 Taaffe Place, Brooklyn, has appointed N. G. Nicoll, formerly in charge of the specialty department in the East of the Cutler-Hammer Manufacturing Company, as manager.

**Magneto Business Good.**—The Splitdorf Electrical Company, 98 Warren Street, Newark, N. J., reports that the prospects for business in 1916 are very bright and that it is expecting the record of last year to be surpassed this year.

**Pass & Seymour, Inc.,** Solvay, N. Y., have recently opened a branch office at 158 Purchase Street, Boston, Mass., which will be in charge of G. L. Hatheway. The New England territory and the Canadian territory will be taken care of through this office.

**The Altorfer Brothers Company,** manufacturer of electrically operated washing machinery, has moved its general office from Roanoke, Ill., to Peoria, Ill. The company is still maintaining its factory and a branch office at Roanoke. It also has a factory at Peoria.

**L. A. Woodward,** former general manager of the William Tod Company, Youngstown, Ohio, has purchased the plant of the Canton-Hughes Pump Company at Wooster, Ohio, which has been in the hands of a receiver. The purchase price is said to have been about $100,000.

**The Henderson Electric Company,** Ampere, N. J., has purchased the Roberts boring-machine business from James McCrea & Company of 562 West Washington Street, Chicago, Ill., including all their patent rights, interest and good will in the Roberts, O. K. and Zeek boring machines.

**St. Paul to Electrify Shops at Dubuque, Iowa.**—Officials of the Chicago, Milwaukee & St. Paul Railroad have announced that a contract has been closed with the Union Electric Company of Dubuque, Iowa, for supplying electrical energy to the large railroad shops at that point.

**The John Z. Dolph Company,** manufacturer of insulating paints and compounds, has moved from 317 New Jersey Railroad Avenue, Newark, to 168 Emmett Street, Newark, where the capacity of its plant will be more than doubled. The change in the plant has been found necessary to take care of increased business.

**The Bowser Tank & Pump Works, Fort Wayne, Ind.,** have appointed C. D. Wheeler, formerly sales and advertising manager of the Santo Vacuum Cleaner Company and advertising manager of the Fort Wayne Works of the General Electric Company, as its advertising manager. Mr. Wheeler will succeed G. A. Townsend, Jr.

**Large Steel-Mill Motor Orders.**—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., reports that the National Tube Company, Lorain, Ohio, has just ordered a 15,000-hp. motor for driving a 40-in. reversing rolling mill. A similar order has also been recently received from the Indiana Steel Company, Gary, Ind.

**The National Electric Utilities Corporation** has moved its factory from 355 West Thirty-sixth Street, New York, to Danbury, Conn., where it is the intention of the company to manufacture household ranges in large quantities, together with hotel, restaurant and club equipment and also electric heating and drying appliances for mills and factories. The company has also established offices and display rooms at 103 Park Avenue, New York.

**Norman B. Hickox,** who until recently was employed in the sales department of the Thomas Cusack Company, Chicago, has accepted a position in the direct-lighting sales department of the National X-Ray Reflector Company of Chicago. Mr. Hickox was formerly with the Greenwood Advertising Company, an electric-sign manufacturer at Nashville, Tenn. Prior to his entry into the commercial electrical field he was engaged in central station work for H. M. Byllesby & Company at Muskogee, Okla., and for the Springfield Gas & Electric Company at Springfield, Ill.

**J. A. & W. Bird & Company,** 88 Pearl Street, Boston, Mass., manufacturers of "Ripolin" enamel paint, have moved their New York office from 66 Beaver Street to the Equitable Building, 120 Broadway. The company is getting its raw material from Holland and has sufficient stocks on hand, it declares, to take care of practically any demand without need of increasing prices.

**The Adsit Telephone Lockout Company.**—The Adsit General Electric Company of Minneapolis, Minn., was recently organized under the laws of Michigan as the Adsit Telephone Lockout Company, with a capital stock of $300,000. The headquarters of the company are now at Escanaba, Mich. J. C. Kirkpatrick is president, M. K. Bissell vice-president, and H. W. Reade secretary and treasurer.

**Philip S. Smith,** formerly of the General Electric Company, has been appointed by the Bureau of Foreign and Domestic Commerce of the Department of Commerce to tour South America and make a special study of the need in that continent for electrical specialties. Mr. Smith will first investigate conditions in Rio de Janeiro and neighboring territory. He will make a tour of the United States among the electrical specialty manufacturers for one month before his departure for South America.

**Demand for Fault-Locating Equipment Increasing.**—The Lundin Electric & Machine Company, Boston, Mass., reports an increasing demand for the Vahey line fault-locating equipment recently placed on the market by this concern. In the past six months sales of this apparatus have doubled, and among recent inquiries received have been one from the Dutch East Indies, one from Mexico, and others from municipal central-station systems. The Lawrence (Mass.) Gas Company and the Minneapolis General Electric Company are among recent purchasers and the Ontario Hydro-electric Commission is an inquirer. Four sets are in use by the central stations managed by C. H. Tenney & Company, Boston.

**Satisfactory Business in Wireless Apparatus.**—The General Radio Company, 11 Windsor Street, Cambridge, Mass., reports that practically all the orders recently received are for small amounts of apparatus from college laboratories. The volume, however, is extremely satisfactory, so much so, the manufacturer asserts, that some difficulty is being had to make satisfactory deliveries. The General Radio Company has recently developed a new type of wave meter which will be placed on the market in the near future. This device will be described in an early issue of the ELECTRICAL WORLD. The officers of the General Radio Company are as follows: Melville Eastham, president; R. C. Watrous, treasurer, and R. C. Emery, secretary.

**General Electric Company Employing Large Force.**—About 18,000 men and women are now being employed, it is reported, in the Schenectady plant of the General Electric Company, and the force is said to be the largest in the history of the company. For the past six months the number of employees has been steadily increased until the present record has been attained. As already noted in these columns, orders are coming in in unprecedented volume, necessitating not only increases in working forces but also in manufacturing facilities. Reports of increased business and correspondingly larger working forces at the other plants of the General Electric Company have also come in. More than 4700 persons are now employed at the Pittsfield plant.

**Instructions for Foreign Customers.**—The Stow Manufacturing Company, Binghamton, N. Y., manufacturer of electrically operated tools, has issued a form letter which it is sending to its customers in foreign countries. This form letter states that customers desiring to place orders with the Stow company may simplify the execution of these orders by giving them to the nearest foreign office of the American Express Company. The letter contains information on how the orders should be made out and gives a list of offices of the American Express Company in foreign cities. The arrangement which the Stow Manufacturing Company has made with the American Express Company, it is thought, should be of considerable benefit to small purchasers in foreign countries.

**Norway Telephone Contract to Western Electric Company.**—The Western Electric Company of Chicago on March 3 obtained the award of a contract to install a full automatic telephone system in Christiania, Norway. The order involves an expenditure of about $1,250,000, and is considered of unusual importance, as it is the largest telephone contract ever given to an American concern in Europe and is a victory over the firm of Siemens & Halske of Berlin. The exchange will consist of 30,100 lines of telephone equipment to be installed in nine offices. There will be automatic dials for 35,000 subscribers. It is understood that certain parts of the exchange not belonging to the automatic system probably will be built by the electric bureau of Christiania and by Siemens & Halske.

**Louisville Contractor Busy.**—The Harry I. Wood Company, 514 West Main Street, Louisville, Ky., has recently secured several interesting contracts. One of these contracts includes all the conduit and wiring work for lighting and power of the Home Telephone Company of Louisville, Ky. The contract also calls for installation of all 2-in. and 3-in. conduits required for the telephone company's equipment. Another contract just received is for the wiring of the Bonnie Apartment House, and it covers a complete conduit system for lighting and power, vestibule telephones, city telephones, bells and annunciators. The Harry I. Wood Company has also received a contract for installation of one 35-hp. motor and two 20-hp. motors for the Ewald Iron Company. Another interesting contract is for the installation of main and branch feeders and other equipment for two 225-kw., 220-volt, three-phase enameling ovens which are being installed by the Ford Motor Company in its plant at Louisville.

**Western Electric Company "Wire-Your-Home" Window Displays.**—Combining the special "Wire-your-home" window display of the Society for Electrical Development, Inc. (reproduced on a preceding page of this issue), with its own standard window display sets, the Western Electric Company, New York City, offers central stations and dealers several settings for attractive window exhibits during the coming house-wiring campaign month. The advertising department of the company, which offers to ship the window-display sets direct upon request, makes the suggestion that the "Wire-your-home" display proper be kept in the dealer's window during the entire month, while the company's standard displays, which form a part of the setting, are changed from week to week, featuring different appliances. One of the combination windows suggested by the Western Electric Company has as its central feature an electrically driven washing machine, from which white-paper streamers lead to six special posters, three on each side of the window, which bear legends setting forth the points of advantage of the electric washer exhibited.

**Success with Individualistic Cut-out Box.**—Warren Ripple, president of the George Cutter Company, South Bend, Ind., recently told a representative of the ELECTRICAL WORLD that the success his company is meeting in marketing its new cut-out box is remarkable. The box itself is a product of higher grade than ordinary and is individualistic in that it is provided with a name-plate on which the electrical contractor installing the equipment may stamp the name of his concern. Because the box contains this feature, which allows the contractor to place his name in a conspicuous place on each completed job, Mr. Ripple said the use of the box is spreading so rapidly that factory facilities must necessarily be pushed to insure prompt deliveries. Mr. Ripple also pointed out the fact that the merchandising idea involved is one somewhat new to the electrical supplies business. Very few products in that branch of the industry are now designed so that the electrical contractor may sell them to the public and at the same time sell with the goods a high-class and lasting advertisement of his local store. He said further that, in spite of the fact that electrical contractors as a body are considered by some to be poor merchants, a great many of them have grasped the merchandising principle embodied in the cut-out-box name-plate and are employing the principle as well as the material daily.

**E. C. Porter,** who for two years has been the commercial agent in charge of the New York office of the Bureau of Foreign and Domestic Commerce, has recently resigned his position to become executive secretary of the recently formed American-Russian Chamber of Commerce. Mr. Porter has had direct charge of the organization and of the arrangements entered into between the Department of Commerce and the imperial Russian government for the purpose of assisting American business interests in importing goods from Russia. As a result of those arrangements, approximately $700,000 worth of Russian materials have been brought into the United States, and this has been of great benefit to American manufacturers. As already noted in these columns, the American-Russian Chamber of Commerce has recently been organized by representatives of some of the leading financial and industrial interests of the country. The chamber is also closely associated with the Russian-American Chamber of Commerce in Moscow.

**The Electric Sales Corporation,** 418 Union Street, Seattle, Wash., has taken over the manufacture and sale of the Apfel system of electric heating formerly placed on the market by Apfel & Jansen and described in the ELECTRICAL WORLD of March 27, 1915. The insert hot-water heater formerly made by Apfel & Jansen and described in the ELECTRICAL WORLD of April 3, 1915, is now being made and placed on the market by the Electric Heating & Manufacturing Company. These two companies, however, cover the sales of these devices only throughout the Pacific Coast States as far east as Montana. The manufacturing and sales rights for the Central States are controlled by the Lee Electric Radiator Company, 319 Wells Street, Chicago, Ill., and it is the licensed manufacturer under letters patent which are owned by P. F. Apfel of Seattle. Mr. Apfel expects to dispose in the near future of the manufacturing and selling rights of the electric-heating system and electric hot-water heater in the Eastern States territory. P. F. Apfel is president of the Electric Sales Corporation, O. L. Whitcomb vice-president, and R. H. Walker secretary and treasurer. The officers of the Electric Heating & Manufacturing Company are as follows: J. G. Eddy of Everett, Wash., president; R. H. Walker, vice-president, and P. F. Apfel, secretary and treasurer. The Electric Heating & Manufacturing Company has a plant with an annual output of 300,000 sq. ft. of radiating surface of electric radiators and 10,000 "Electric Insert" hot-water heaters. This company also manufactures electric glue pots, electric automobile radiator heaters, and other special electric-heating devices. The business of the latter-named company is in a prosperous condition, it reports, and bids fair to become one of the leading industries of the Pacific Coast. The Electric Sales Corporation announces that one of the largest successful installations of automatic electric-heating systems for water ever made has been installed in the country residence of R. P. Butchart on Vancouver Island, British Columbia. The installation consists of a battery of eighteen insert hot-water heaters with a total rating of 412 amp., giving a consumption per hour of about 46 kw. The apparatus is utilized for heating a swimming tank containing 12,000 gal. of sea water. The heaters are usually employed during the night hours and are automatically cut off in the morning or when the temperature attains 80 deg. Fahr.

## NEW YORK METAL MARKET PRICES

| | Feb. 29 Selling Prices Bid | Feb. 29 Selling Prices Asked | March 7 Selling Prices Bid | March 7 Selling Prices Asked |
|---|---|---|---|---|
| Copper | £ s d | | £ s d | |
| London, standard spot | 105 10 0 | | 100 10 0 | |
| Prime Lake | 28.25 to 28.50† | | 27.25 | to 27.50† |
| Electrolytic | 28.25 to 28.50† | | 27.25 | to 27.50† |
| Casting | 26.75 to 27.00† | | 25.87½ | to 26.12½† |
| Copper wire base | 29.25 to 29.75† | | 28.75 | to 29.25† |
| Lead | 6.30 | | 6.60 | |
| Nickel | 45.00 to 50.00 | | 45.00 | to 50.00 |
| Sheet zinc | 25.00† | | 25.00† | |
| Spelter, spot | 20.55 to 20.80† | | 18.67½ | to 18.92½† |
| Tin, Straits | 48.00 | | 48.50 | |
| Aluminum, 98 to 99 per cent. | 58.00 to 59.00 | | 59.00 | to 61.00 |
| **OLD METALS** | | | | |
| Heavy copper and wire | 22.00 to 22.50† | | 21.50 | to 22.00† |
| Brass, heavy | 14.00 to 14.25† | | 13.50 | to 14.00† |
| Brass, light | 12.00 to 12.50† | | 12.00 | to 12.50† |
| Lead, heavy | 5.25 to 5.40† | | 5.40 | to 5.50† |
| Zinc, scrap | 15.00 to 15.50† | | 15.00 | to 15.50† |

**COPPER EXPORTS**

Total tons to March 7 ..... 4,115

†Nominal.

## Corporate and Financial

**American Power & Light Company, New York, N. Y.**—The company is offering to holders of its preferred and common stock and to holders of option warrants for its common stock the privilege to subscribe after March 1 and on or before March 15 for an amount of 6 per cent gold debenture bonds equal to 50 per cent of the par value of their respective holdings as registered on the company's books Feb. 21, 1916. The total amount of bonds offered to stockholders is $6,984,300. The subscriptions for the bonds are to be made at 93 per cent and accrued interest, and the purpose of the issue is to liquidate the company's floating debt, which aggregated $3,489,141 on Dec. 31, 1915, and to supply additional working capital.

**Dayton (Ohio) Power & Light Company.**—The annual report of the board of directors for the calendar year 1915 says: "We have enjoyed a satisfactory year, and your officers feel that the results have measured up to the highest standard of growth established in past years. A brief analyzation of the results of our 1915 operations discloses an increase in the number of customers connected to our lines of 4562. It also shows an increase in our total connected load of 12,525 hp. It is gratifying to note that our earnings from the sale of electric energy for industrial power purposes shows an increase over the previous year of approximately 24 per cent. During the year we have added six towns and several unincorporated communities to our system and have secured franchises from two towns that will be served with the completion of our lines to those points. All indications point to a satisfactory development of your company during the year 1916, and your officers are of the opinion that the percentage of increases in the various branches of the business will at least equal those of 1915." The comparative earnings statement for 1914 and 1915 follows:

| | 1915 | 1914 |
|---|---|---|
| Gross earnings | $1,098,065 | $943,321 |
| Operating expenses | 579,581 | 528,151 |
| Net earnings | $518,484 | $415,170 |
| Other income | 12,987 | 11,842 |
| Total income | $531,471 | $427,012 |
| Fixed charges | 217,932 | 207,647 |
| Net income | $313,539 | $219,365 |
| Dividend on preferred stock | 128,347 | 116,220 |
| Net surplus | $185,192 | $103,145 |

**Denver (Col.) Gas & Electric Company.**—An issue of $4,000,000 of first and refunding 5 per cent sinking-fund gold bonds due May 1, 1951, is being offered at 92 and interest, netting 5.5 per cent. The bonds are being sold for the purpose of anticipating the maturity of $3,500,000 of 6 per cent collateral-trust notes of the company, which mature in about one year, practically all of which issue, it is expected, will be called for redemption next October.

**Electric Bond & Share Company, New York, N. Y.**—The gross income of the company for the year ended Dec. 31, 1915, was $1,820,337 and the net income $1,401,085. During the year $344,647 was paid out in dividends on preferred stock and $433,788 in dividends on common stock. The surplus income for the year was $622,660. There was on hand and in banks on Dec. 31, 1915, cash amounting to $2,066,209. There were accounts receivable to the amount of $476,206, notes receivable to the amount of $282,995, and accrued interest receivable to the amount of $90,607, making a total of $2,916,018 of current assets. Against this are placed current liabilities of but $62,760, divided into $2,760 for accounts payable and $60,000 for the preferred-stock dividend of Feb. 1. The total surplus as of Dec. 31, 1915, was $4,244,566, which was larger than that of a year previous by $1,048,869.

**Evansville (Ind.) Public Service Company.**—The Public Service Commission of Indiana has granted the company authority to issue $1,105,200 of bonds to be sold at not less than 85. The company is also authorized to increase the capital stock by $320,000.

**Interstate Electric Company, New York, N. Y.**—A block of first-lien 6 per cent collateral sinking fund gold bonds due March 1, 1933, is being offered at par and interest.

**Kansas Electric Utilities Company, Lawrence, Kan.**—An issue of $1,150,000 of first-mortgage ten-year 5 per cent sinking-fund gold bonds, due Oct. 1, 1925, is being offered at 94.5 and interest to yield 5.75 per cent.

**Northern Iowa Gas & Electric Company, Humboldt, Iowa.**—The company has recently purchased the central station properties at Eagle Grove, Clarion, Goldfield, Humboldt, and the properties supplied by transmission lines from Humboldt and Sheldon, which are Dakota City, Gilmore, Rolfe, Laurens, Pomeroy, Livermore and Fonda. It is the intention of the company to build a transmission line from Humboldt to Eagle Grove and to Clarion. The hydroelectric and steam plant at Humboldt will be supplemented by a steam plant at Eagle Grove. The officers of the company are: I. C. Elston, Jr., president; D. M. Sterns, vice-president, and J. N. McCallum, secretary and treasurer.

**Northern California Power Company, Consolidated, San Francisco, Cal.**—The annual meeting of the stockholders of the company was held in San Francisco, Feb. 3. Despite the fact that the gross earnings of the company in 1915 were the largest in its corporate history except in 1913, and that 584 new customers were added to its roll last year, the annual report showed a decrease of $12,222 in net earnings and a decrease of $10,815 in balance, after interest charges. The report submitted by W. F. Detert, president, states that the company's series B debentures, amounting to $500,000, will have to be paid. The stockholders will be called upon to provide this sum either in one assessment or several smaller assessments. He also stated that during the next eighteen months $115,000 will be required to meet bond sinking funds, while the minimum amount of extensions and betterments will be approximately $200,000 in excess of the amounts available from the company's revenues, making due allowance for probable increase in same, which sums will also have to be met by the stockholders unless unexpected increases are realized in the company's business. A comparative statement of the income and surplus accounts for 1914 and 1915 follows:

| | 1915 | 1914 |
|---|---|---|
| Gross operating revenue | $776,973 | $765,047 |
| Maintenance, operating expenses, taxes and uncollectible accounts | 342,453 | 323,587 |
| Net earnings from operation | $434,520 | $441,460 |
| Add profit on merchandise sales and other miscellaneous income | 8,511 | 13,794 |
| Total net income | $443,031 | $455,254 |
| Interest on bonds, debentures and floating debt (less amount charged to capital for work in course of construction) | 362,896 | 363,998 |
| Balance | $80,135 | $91,256 |
| Less debt discount and expense and miscellaneous deductions from income | 705 | 1,011 |
| Balance | $79,430 | $90,245 |
| Add miscellaneous additions to surplus | 2,165 | 144 |
| Balance | $81,595 | $90,389 |
| Deduct extraordinary accounts written off affecting previous years | 32,609 | 20,333 |
| Balance | $48,986 | $70,056 |
| Less reserve for depreciation | 17,677 | 32,817 |
| Balance | $31,309 | $37,239 |
| Less appropriations to sinking funds: | | |
| For payments made during year | 104,910 | 103,710 |
| For payments made in previous years | 60,000 | 57,484 |
| For amounts due and accrued but unpaid | 89,931 | ..... |
| Balance to corporate surplus | *$223,532 | *$123,955 |
| Surplus unappropriated at beginning of year | 463,135 | 587,090 |
| Dec. 31 surplus, a sper balance sheet | $239,603 | 463,135 |

*Deficit.

**Pennsylvania Water & Power Company, Holtwood, Pa.**—The earnings of the company for the year ended Dec. 31, 1915, were as follows:

| | | |
|---|---|---|
| Gross earnings | | $1,124,739 |
| Operating expense | $64,460 | |
| General expense | 67,884 | |
| Maintenance | 44,064 | |
| | | 176,408 |
| Balance | | $948,331 |
| Interest on first-mortgage bonds | | 514,278 |
| Net revenue | | $434,053 |
| Balance from 1914 | | 710 |
| Total | | $434,762 |
| Distributed as follows: | | |
| Dividends | | $339,800 |
| Transferred to contingent fund | | 73,164 |
| Surplus carried to profit and loss | | 21,798 |
| Total | | $434,762 |

**Utah Power & Light Company, Salt Lake City, Utah.**—Officials of the company, it is reported, have devised a tentative plan to sell stock in the company to employees on a monthly installment basis. The plan is being formulated for the purpose of increasing efficiency and co-operation and giving employees a chance to acquire stock on easy payments. While the complete details of the plan are still in the making, it is virtually assured that it will go into effect about April 1. As it is now planned, stock will be sold to employees at the par value of $100, paying $5 down and $5 a month. At the same time, the dividends on the stock with interest will be credited to employees investing at the rate of 7 per cent.

**West Penn Power Company, Pittsburgh, Pa.**—An issue of $8,500,000 of first mortgage 5 per cent gold bonds, series "A," dated March 1, 1916, and due March 1, 1916, is being offered at 95.5 and interest. The proceeds of the $2,000,000 of preferred stock sold will be used in the payment of all the funded and other obligations of the consolidated companies, leaving the property of the West Penn Power Company free from all indebtedness except these bonds and with $2,000,000 in cash in its treasury to be invested in its property. Under the mortgage the company must construct or acquire a new power plant of not less than 40,000 hp. before Jan. 1, 1921.

## New Utility and Industrial Companies

**The Cassandra Light Company** of Portage, Pa., has been incorporated with a capital stock of $5,000 by William H. Troxell, High Sparks; James Pearce and Margaret Pearce, Portage.

**The Ballinger Electric Light & Power Company**, Ballinger, Tex., has been chartered with a capital stock of $50,000. The incorporators are R. H. Irvine, M. F. Treadwell and W. G. Fricke.

**The Portage Township Light & Power Company** of Portage, Pa., has been incorporated with a capital stock of $5,000 by William H. Troxell, High Springs, Pa.; James Pearce and Margaret Pearce, Portage.

**The Street Electric Company** of Memphis, Tenn., has been incorporated by R. A. Street, W. C. Tupper, W. S. Counsell and D. Street. The company is capitalized at $100,000 and purposes to do a general electrical business.

**The Everett-Buschmann Company** of Indianapolis, Ind., has been incorporated with a capital stock of $1,000 to deal in power-plant specialties. The incorporators are William J. Everett, T. B. Everett, A. W. Buschmann and O. Buschmann.

**The Anderson Electric Specialty Company** of Chicago, Ill., has been chartered with a capital stock of $50,000 by William L. Hall, Charles E. Burnap and Charles O. Shervey. The company intends to manufacture and deal in electrical devices.

**The Lucerne Electric Light Company** of Lucerne, Mo., has been incorporated with a capital stock of $3,200 to supply electricity for lamps and motors in Lucerne. The incorporators are S. L. Prough, O. E. Snyder and W. M. Boland.

**The Fahrig Electrical Company** of Chicago, Ill., has been incorporated with a capital stock of $6,000 to carry on a general electrical and mechanical business. The incorporators are C. Fahrig, Rudolph Fahrig and Graham Van Ness.

**The Lamson Electrical Manufacturing Company** of Chicago, Ill., has been incorporated by W. Bachrach, S. W. David and A. H. Marshall. The company is capitalized at $5,000 and purposes to manufacture and deal in electrical and mechanical specialties.

**The Upper Alsace Electric Company** has been granted a charter with a capital stock of $10,000 to operate in Upper Alsace Township, Berks County, Pa. The incorporators are S. D. Warriner, R. H. Wilbur and H. F. Baker, Lafayette Building, Philadelphia, Pa.

**The Wolverine Spark Plug Company** of Dayton, Ohio, has been incorporated by W. Bohleber, P. S. Linton and C. H. Braselton, Reibold Building, Dayton, Ohio. The company is capitalized at $100,000 and intends to manufacture and deal in ignition devices for internal-combustion engines.

**The Magneto Winding Company** of Millbrook, N. Y., has been chartered with a capital stock of $6,000 to manufacture and deal in armatures, coils, electric motors, magnetos, dynamos, autos, etc. The incorporators are D. Kassel, S. Sydney Krim and G. S. P. Kleeberg, 110 West Seventy-sixth Street, New York, N. Y.

## Trade Publications

**Platinum.**—Baker & Company, Inc., Newark, N. J., have issued a very complete illustrated catalog which contains information on various products made of platinum.

**Steel-Tower Outdoor Substations.**—The Delta-Star Electric Company, Chicago, Ill., has issued descriptive leaflet No. 770, which contains information on and illustrations of its type SD steel-tower outdoor substations.

**Telephone Apparatus for Interior Use.**—Catalog No. 24 prepared by the Connecticut Telephone & Electric Company, Meriden, Conn., describes and illustrates a large number of types of telephones and telephone accessories for interior use.

**Salesmen's Lamp Handbook.**—The Westinghouse Lamp Company, 1261 Broadway, New York, has just issued the fifth of its salesmen's lamp handbooks. The book is entitled "Selling Mazda Lamps and Better Light" and contains model sales talks for selling tungsten lamps.

**Interchangeable-Letter Sign.**—L. F. R. Bellows & Company, 10 West Larned Street, Detroit, Mich., sales agent for the Flexlume Sign Company of Buffalo, N. Y., has prepared an illustrated folder describing a new type of interchangeable-letter electric sign adapted for use by motion-picture theaters.

**Incandescent Headlamps.**—The General Electric Company, Schenectady, N. Y., has recently issued Bulletin No. 43,800, entitled "Incandescent Headlights for Street Railway Service." The company has also just brought out Bulletin No. 44,001-I, which contains a price list of renewal parts and supplies for car equipments, mine locomotives, and railway and mine line material.

**Rust-Proof Iron.**—The American Rolling Mill Company, Middletown, Ohio, has recently issued an attractively prepared catalog entitled "Defeating Rust: The Story of Armco Iron." The company has also just prepared illustrated catalogs entitled "The Making of Armco Iron" and "Armco-American Ingot Iron," the latter containing letters of appreciation of the company's products.

**Reflector and Wireless Battery Cabinets.**—W. R. Ostrander & Company, 22 Dey Street, New York, have prepared a folder entitled "Wireless Battery Cabinet," which also lists the company's manufactured products, and a circular entitled "Sun Ray Reflectors for Store Window Lighting," which contains information on an angular reflector with metal on the outside and lined with silver-ripple glass.

**Printing-Press Motors and Controllers.**—"Direct-Current Motors and Controllers for Flat-Bed and Small Rotary Printing Presses" is the subject of Bulletin No. 48,705, recently issued by the Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York. The company has also recently prepared a small catalog printed in colors which contains information on various types of its electrically operated fans.

**Westinghouse Products.**—Commutating-pole rotary converters are described and illustrated in Leaflet No. 3823-A, just issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The company has also issued Folder No. 4201, entitled "The ABC of Automobile Battery Charging," which gives some concise information with reference to the recharging of automobile batteries by the owner; Catalog No. DS846 on "Pole-Line Hardware," Catalog Section No. IP54 on "Type CW Slip-Ring Induction Motors," Catalog Section No. DS919 on "Switchboard Meters for Measuring Pressure, Current and Energy," Leaflet No. 3763 on its railway motor No. 532-B, and Leaflet No. 3818 on its type C push-button control stations for use in automatic motor starters and controllers.

## New England

AUGUSTA, ME.—The Central Maine Pwr. Co., Augusta, has placed a contract for an additional steam-turbine generating unit of 2000-kva. rating for the steam-power station at Farmingdale. H. W. Ellis is general superintendent.

LEWISTON, ME.—Bids will be received at the omce of the supervising architect, Treasury Department, Washington, D. C., until April 3 for a conduit and wiring system, lighting fixtures, etc., in the United States post office, Lewiston, Me. For details see proposal columns.

PORTLAND, ME., The Cumberland County Pwr. & Lt. Co., Portland, is contemplating the development of a power site on the Saco River at Hiram. The plans provide for the installation of a 3000-kw. generating unit and the erection of 20 miles of transmission line, to cost about $300,000.

SWANTON, VT.—Within the next six months an additional generating unit, consisting of a 500-kva. or 750-kva., 600-volt generator directly connected to waterwheel, will be installed in the municipal electric-light plant. The town of Swanton expects to purchase within the next two months a 500-kva., three-phase, 6600-volt generator and waterwheel, to operate under a 40-ft. head, an oil-pressure waterwheel governor, necessary switches, exciter, one Tirrill regulator and 6 miles of No. 4 bare copper wire. C. J. Parker is superintendent.

BROCKTON, MASS.—The Edison El. Illg. Co. of Brockton is completing a 7-mile 13,000-volt transmission line and transformer station of 4000-kva. rating. The company has also under construction a transformer and distribution station having an output of 1200 kw. to be completed within the next two months, and is now starting work on an adddition to its power plant, which will house a 10,000-kw. turbo-generator unit with necessary auxiliary equipment, including boiler and new tank. W. A. Forbush is plant superintendent.

CONCORD, MASS.—The municipal electric department has been requested to submit a proposition for furnishing electrical energy (500 hp.) to the Strathmore Worsted Mills.

FALMOUTH, MASS.—The Buzzards Bay El. Co., Falmouth, is planning to extend its 33,000-volt transmission line to Osterville and erect a 2200-volt, three-phase distributing system in that village, Wianno and Centerville on Cape Cod. H. H. Taylor is general manager.

ROWLEY, MASS.—The purchase of lightning arresters, wire, incandescent lamps, etc., is contemplated for the municipal electric-lighting system. S. O. Kent is manager.

MERIDEN, CONN.—The Meriden El. Lt. Co. has been awarded a 10-year contract for street-lighting. The company has recently completed the installation of underground conduits in the business district covering 18,000 ft., preparatory to placing overhead wires underground.

## Middle Atlantic

BATAVIA, N. Y.—Bids will be received by the city of Batavia at the office of I. J. Carmichael, city clerk, Batavia, until March 23 for construction of a 3,000,000-gal. rapid sand-filter plant, water-works pumping station, force mains, water-tube boilers, brick stack, steel elevated tank, one cross-compound Corliss engine or Meyer-gear pumping engine, two engine-driven centrifugal pumps, one engine and electric generator, two separate generators, three motor-driven centrifugal sewage pumps, surface condenser, moving and erecting two existing water-works pumps, rebuilding sewage pumping station, auxiliary equipment and other appurtenances. Plans may be seen at the office of the city clerk and may be obtained upon application to Chester & Fleming, engineers, Union Bank Building, Pittsburgh, Pa., on deposit of $50 for pumping station or filter plant and $25 for machinery.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 14 for furnishing interior communication cable, single and twin-conductor wire, etc., at the navy yard, Brooklyn, N. Y. Proposal blanks may be obtained at the above bureau or the Navy Pay Office, New York, N. Y.

BROOKLYN, N. Y.—Bids will be received at the office of the Mayor, City Hall, borough of Manhattan, until March 16 for the installation of new lighting system, etc., in drill shed, Thirteenth Coast Defence Command Armory, borough of Brooklyn. Blank forms and other information may be obtained at the office of the Armory Board, Room 6, basement, Hall of Record.

# *Construction*

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BROOKLYN, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 21 for furnishing ship and motor-boat bells, steel conduit, foundry crane, bunker lamps, deck lanterns, sheet lead, after range, masthead and side lamps, searchlight mirrors, signaling searchlights, steel tanks, etc., at the navy yard, Brooklyn. Proposal blanks may be obtained at the Navy Pay Office, New York, and at the above bureau.

BUFFALO, N. Y.—Plans have been filed by the Buffalo General Electric Co. for the erection of a steel power house at 803 Perry Street, Buffalo.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Pwr. Co., Buffalo, has secured the right-of-way for the erection of its proposed transmission line from Lewiston to Niagara Falls. The company has begun work on the erection of the line from its power station in Cambria to the plant of the Union Carbide Co., Niagara Falls.

DUNKIRK, N. Y.—Estimates for the cost of installing additional equipment in the municipal electric plant so as to supply the demands of the large manufacturers for energy have been asked by the Water Board. The Council does not favor the proposal to grant the Niagara & Erie Pwr. Co., Fredonia, a franchise in Dunkirk so as to supply electricity to the Atlas Steel Co. and other large industries.

NEW YORK, N. Y.—Bids will be received at the Medical Supply Depot, United States Army, 543 Greenwich Street, New York, N. Y., until March 17 for furnishing hospital supplies, including 24 compressed-air apparatus, 24 electric apparatus, etc. Further information may be obtained on application to Col. Charles Richard, in charge of depot.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until March 20 for installing electric-light equipment in Public Schools 41, 88, 124, 140 and 161, borough of Manhattan. A separate proposal must be submitted for each school. Blank forms and specifications may be obtained at the above office.

FORTY-FORT, PA.—Several buildings, it is reported, will be erected by the Jenkins-Kirby Packing Co., which will include a four-story factory building, a garage, a two-story potato house and a power house with wing. McCormick & French, Wilkes-Barre, Pa., are architects.

HARRISBURG, PA.—The Pennsylvania R.R. Co. has announced plans providing for equipping all tracks and switches in the Enola freight yards near here for electrical operation.

LANCASTER, PA.—Surveys are now being made for the construction of an electric railway between Lancaster and Holtwood, on the Susquehanna River, where the hydroelectric plant of the Pennsylvania Wtr. & Pwr. Co. is situated.

GUTTENBERG, N. J.—Bids will be received by the Town Council until March 20 for lighting the streets, avenues and highways of the town of Guttenberg. William J. Bramley is town clerk.

HACKETTSTOWN, N. J.—The installation of a hydroelectric power plant is under consideration by George Z. Williams, Independence Township, on property recently acquired on Request Creek.

TRENTON, N. J.—Bonds to the amount of $15,000 have been authorized by the City Commission for the installation of an electric-lighting system in Stacy Park.

BLUE MOUNTAIN (not a post office), MD.—Plans are being prepared by Walter M. Gieske, Gunther Building, Baltimore, for the erection of a hotel (250 rooms) for the Blue Mountain Hotel Co., to cost about $260,000. The plans provide for electric lighting, electric elevators, mechanical heaters and filters, etc. John J. Gibbons, care Western Maryland Ry. Co., Baltimore, is manager.

CUMBERLAND, MD.—The Cumberland & Westernport El. Ry. Co. is contemplating enlarging its power plants at Eckhard and Reynolds.

HIGHLANDTOWN, MD.—The Pennsylvania Wtr. & Pwr. Co., Holtwood, it is reported, will finance the cost of the additional unit which the Shawinigan Electric Products Co. will erect at its plant in Highlandtown, at a cost of about $100,000. The engineering department of the Pennsylvania company has its offices in the United States Fidelity & Guarantee Building, Baltimore.

EAST RADFORD, VA.—The Winefrede Coal & Coke Co., East Radford, would like prices, etc., on mining machinery, building materials, electrical equipment, including generator sets, switchboards, panels, motors, mining cars, etc.; also coal-washer equipment and tipple. W. W. McElrath, Jr., is manager.

WINCHESTER, VA.—The city of Winchester has abandoned the project to install a municipal electric-light plant.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until March 17 for clock and program system and electric work at the Western High School building No. 117. Specifications and all necessary information may be obtained from the chief clerk, engineer department, Room 427, District Building, Washington, upon deposit of $5.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until March 20 for furnishing and installing miscellaneous equipment for the Central High School building, including gas logs, pottery kiln, electric irons and boards, laundry drier, gas stove and safe, forge and machine-shop equipment, blowers, compressor, tank and miscellaneous woodworking machinery, etc. Specifications and other information may be obtained from the chief clerk, engineer department, Room 427, District Building, upon deposit of $5.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Norfolk, Va., Schedule 9405—eight 5-kw. radio motor-generator sets, eight automatic panels (contactor type) and 14 radio transformers. Brooklyn, N. Y., Schedule 9398—20 electric heaters (120-volt); Schedule 9403—two horizontal centrifugal pumps. Great Lakes, Ill., Schedule 9380—one Roentgen-ray machine. Charleston, S. C., Schedule 9384—one electric traveling hoist. Applications for proposals should designate the schedule desired by number.

## North Central

DETROIT, MICH.—Contract has been awarded by John H. Kunsky to the Schmied-Sisman Co. for the erection of an office and theater building at Broadway and Grand Circus Park, Detroit. Electric equipment will be installed to supply electricity for lamps and motors for the building. C. Howard Crane is architect.

GRAND RAPIDS, MICH.—A power house is to be erected in connection with the five new buildings for the John Calvin College. Part of the contracts have been awarded. Orders for the equipment, it is understood, have not yet been placed. Williamson & Crow are architects.

HAMTRAMCK, MICH.—Extensive additions and improvements are being made to the power plant of Dodge Brothers Motor Car Mfg. Co. at Hamtramck.

HASTINGS, MICH.—The Thornapple Gas & El. Co., Hastings, it is reported, is planning to increase the output of its steam-power plant here. The company is also contemplating extending its transmission line to Vermontville, where the citizens have voted to replace the present street-lighting system with modern lamps.

NILES, MICH.—The Board of Public Works is contemplating the purchase of an auxiliary engine, probably Diesel type, of about 125 hp. F. S. Hadfield is superintendent.

PORTLAND, MICH.—The installation of two new waterwheels and governors for same in the municipal electric-light plant is under consideration. Frank L. Jenkins is superintendent.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioners of purchases and supplies, City Hall, Cleveland, until March 14 for underground lead cables for the department of fire. Specifications may be obtained on application to the director of public safety, 207 City Hall.

CLEVELAND, OHIO.—The Cleveland & Sharon R.R. Co. has applied to the Public Utilities Commission for permission to sell $185,000 in bonds and $75,000 in capital stock for the construction of an electric railway between Middlefield and Lockwood, a distance of 12 miles. Extensions are planned both north and south. C. H. Felton is secretary.

DEFIANCE, OHIO.—The Defiance Gas & El. Co. is contemplating changing all of its 25-cycle system to 60-cycle (major portion is now 60-cycle). This will embrace

the changing of two 1000-kw. engine-driven units and also changing of all 25-cycle motors and meters to 60-cycle. The company expects to start a campaign for the sale of vacuum cleaners soon. W. P. Wallace is general manager.

FINDLAY, OHIO.—The Toledo, Bowling Green & Southern Trac. Co., Findlay, has recently closed a contract with the General Electric Co. for a 1000-kw. turbine. Charles F. Smith is general manager.

GREENFIELD, OHIO.—The Board of Public Affairs is contemplating the installation of an ornamental street-lighting system during this year. W. Roy Gray is manager.

HAMILTON, OHIO.—Improvements and extensions to the municipal electric-light plant, to cost about $69,000, are recommended in the report submitted to the City Council by James O'Toole, superintendent, which include a 1000-kw. generating unit, a new boiler for the power plant, the erection of an ornamental lighting system, new lamps for city parks, changing the present arc lamps in use to incandescent lamps and various other repairs.

HICKSVILLE, OHIO.—The installation of a 500-kw., 60-cycle, 2300-volt directly connected generating unit is under consideration by the Hicksville El. Lt., Ht. & Pwr. Co.

MECHANICSBURG, OHIO.—Work will soon begin by the Mechanicsburg Lt. & Pwr. Co. on changing its entire system from direct current to alternating current. Meters, transformers and new street-lighting equipment are supplied under contract with the General Electric Company. New entire alternating-current equipment to be installed. The company will have considerable large copper wire (second-hand) to dispose of, as well as all direct-current equipment. Fritz Long, treasurer and manager.

NEW PHILADELPHIA, OHIO—The Ohio Service Co., which owns and operates the County El. Co., New Philadelphia, has purchased one 2500-kva. General Electric turbine with condenser and one 500-hp. Stirling boiler for its local electric-light plant. C. H. Howell, Coshocton, is manager.

NORWOOD, OHIO.—Improvements are contemplated to the municipal electric-light plant, including the installation of two 375-kw., 2300-volt generators, two 500-hp. Heine boilers with Jones stokers, and one General Electric rectifier, for 75-arc lamp circuit to be installed, and one Bartlett continuance water softener. One-third more of the municipal distributing system is to be changed from 220 volts, direct current, to 2300 volts, alternating current. E. W. Rich is superintendent.

SHELBY, OHIO.—The municipal electric-light plant is at present in process of reconstruction, being changed from 133 cycles, 1100 volts, to 60 cycles, 2300 volts (some 60-cycle apparatus has been in use), and from single-phase to three-phase. The output of the plant is being increased from 275 kva. to 475 kva. At present no equipment is needed, but more will be needed shortly. Norman R. Cadwell is superintendent.

SIDNEY, OHIO.—The Sidney El. Co. is planning to increase the output of its plant by 750 kw. by installing frequency changers to take energy from 25-cycle transmission lines. Two frequency changers, high-tension transformers, switching equipment, etc., will be required. F. D. Elwell is manager.

WEST MILTON, OHIO.—L. A. Pearson, owner of the Stillwater Valley electric plant, is contemplating the erection of a 5 miles of transmission lines to nearby towns.

MURRAY, KY.—The City Council has engaged X. A. Kramer, Magnolia, Miss., consulting engineer, to prepare plans for the installation of an electric-lighting plant in connection with the water-works pumping station. The Council is considering submitting the proposal to issue $20,000 in bonds to the voters for the construction of a municipal electric plant.

RUSSELL SPRINGS, KY.—Steps have been taken by members of the Commercial Club relative to the installation of an electric-light plant in Russell Springs.

BOONVILLE, IND.—The Boonville El. Lt. & Pwr. Co. is contemplating the installation of a new return tubular boiler (not yet purchased) during June or July. K. H. Weyerbacher is secretary and manager.

COLUMBUS, IND.—The City Council has voted to reconstruct the municipal electric-light plant, at a cost of from $15,000 to $20,000. It is proposed to supply electricity for commercial purposes. At present the municipal plant supplies energy for street lamps and public buildings.

INDIANAPOLIS, IND.—The Indianapolis Lt. & Ht. Co. has begun work on the construction of a new power station on the site of the present plant. The company is now installing water-tube boilers of 250 lb. working pressure, with 200 deg. superheat; also has purchased a 5000-kw. turbine for installation next July. Thomas A. Wynne is vice-president.

TOPEKA, IND.—A 20-hp. oil engine and a 15-kva. generator and switchboard are being installed at the local plant owned by S. P. Hull. Transformers will be installed to take care of the power business which develops after the day service is established on March 6, and lightning arresters for protecting same.

ALTO PASS, ILL.—The Curtis Milling Co., which owns and operates the local electric-lighting plant, is contemplating the installation of an ice factory and cold-storage plant and extending the electric service to Makanda, a distance of 8 miles. E. E. Curtis is treasurer and purchasing agent.

CHAMPAIGN, ILL.—The construction of an electric railway between Champaign and Bloomington, a distance of 50 miles, is contemplated by the Illinois Trac. Co., Champaign.

CHAMPAIGN, ILL.—The Urbana & Champaign Ry., Gas & El. Co., Champaign, is contemplating the installation of an 1800-kw., three-phase, 60-cycle, 2300-volt turbo-generator set, three 500-hp. boilers, with chain-grate stokers, an 18-ft. by 225-ft. concrete stack and a new gas plant in the near future. H. J. Pepper is superintendent.

PEORIA, ILL.—The City Council has appointed a committee to make investigations relative to the installation of a municipal electric-light plant in Peoria.

SPRING VALLEY, ILL.—The Spring Valley Utilities Co. contemplates the purchase of three 200-kva., 33,000/13,200-volt or 6600-volt transformers, and also cedar poles and wire for 15 miles of 13,000-volt transmisison line. R. W. Brown is secretary.

STOCKTON, ILL.—The Stockton El. Co. is contemplating the installation of a 30-kw. to 50-kw., three-phase, 60-cycle, 2300-volt generator. The company will soon establish a 24-hour service. H. A. Smith is president.

WALNUT, ILL.—The Illinois Northern Utilities Co. is considering the installation of a new plant to develop at least 150 hp. W. J. Larson is chief engineer.

WHEATON, ILL.—Bids will be received by the City Council, City Hall, Wheaton, until March 18 for furnishing and erecting complete an internal-combustion engine of not less than 90 brake hp. Bidders may submit proposals on an oil engine or a gas-producer and gas-engine outfit. Specifications may be seen and secured at the office of La Verne J. Ruddock, city engineer, Wheaton.

LOMIRA, WIS.—The Lomira El. Lt. & Pwr. Co. contemplates remodeling its power plant, which will include the installation of new electric generating equipment. A. E. Carpenter is engineer.

MADISON, WIS.—The installation of an electric fire-alarm system in the university buildings is under consideration by the directors of the University of Wisconsin. Information on the various systems now in use is desired. N. L. Thorkelson is business manager.

BARRETT, MINN.—At an election to be held March 14 the proposal to establish an electric-lighting system in Barrett will be submitted to the voters.

ELY, MINN.—Bids will be received by the city of Ely at the office of Arthur Knutson, city clerk, until March 21 for the sale of a 13-in. by 12-in. Skinner automatic steam engine directly connected to a 50-kw. Westinghouse three-phase, 60-cycle, 2300-volt generator with belted exciter, rheostats, etc. For details see proposal columns.

MINNEAPOLIS, MINN.—Bids will be received by the Board of Education, Minneapolis, until March 20 for general work, heating, ventilating, plumbing and electrical work for gymnasium addition to Holland School, Seventeenth Avenue, N. E., and Washington Street. Plans and specifications may be seen at the office of the Board of Education, 305 City Hall, and Rose & Harris, engineers, 470 Auditorium Building, Minneapolis.

IMOGENE, IOWA.—The Council is considering calling an election to submit to the voters the proposal to issue $5,000 in bonds for the installation of a municipal electric-lighting system in Imogene.

SHEFFIELD, IOWA.—The Sheffield El. Lt. & Pwr. Co. is installing a 225-hp. Westinghouse steam condensing turbine with a 137½-kva. alternator and exciter; also one "Stocker" cooling tower with jet condenser. C. C. Carhart is owner and manager.

SHELDON, IOWA.—The property of the Sheldon Lt. & Pwr. Co. is reported to have been purchased by the Northern Iowa Pwr. Co., Humboldt. Improvements will be made by the new owners, involving an expenditure of about $60,000.

CARUTHERSVILLE, MO.—The Caruthersville & Kennett El. Lt. & Pwr. Co. contemplates enlarging its electric plant.

MOUNT VERNON, MO.—The City Council has called a special election to submit the proposal to issue $8,500 in bonds for the construction of a municipal electric-light plant to replace the city plant recently destroyed by fire. Albert C. Moore, Frisco Building, Joplin, Mo., is engineer.

DAZEY, N. D.—The installation of a municipal electric-light plant in Dazey is under consideration.

LANSFORD, N. D.—The Northern Tel. Co., Lansford, is contemplating the installation of a new gas-engine-driven generating unit, consisting of a generator and an internal-combustion unit. C. F. Guss is manager of lighting plant.

WILLISTON, N. D.—The city of Williston has awarded a contract for the installation of an ornamental street-lighting system, consisting of 217 lamp standards, to be completed by June 1. C. C. Mackenroth is superintendent.

FLANDREAU, S. D.—The Dakota Lt. & Pwr. Co., Flandreau, is contemplating the installation of a 200-kva. generating unit, using gas-producer engine. A. H. Savage is treasurer.

SYRACUSE, NEB.—The installation of a municipal electric-lighting plant in Syracuse is under consideration.

ABILENE, KAN.—The Riverside Lt. & Pwr. Co., Abilene, is planning to extend its transmission lines north to Oakhill and intermediate towns and south to Herrington and Hope in the near future. R. B. Gemmill is superintendent.

BLUE RAPIDS, KAN.—The Marshall County Pwr. & Lt. Co., Blue Rapids, is contemplating the installation of an auxiliary plant later on.

CUBA, KAN.—Application has been made to the City Council by E. C. Preble for a franchise to construct and operate an electric-light plant in Cuba.

EASTON, KAN.—An election will soon be called to submit to the voters the proposal to establish a municipal electric-light plant in Easton.

MANCHESTER, KAN.—Application has been made to the town officials by the Riverside Lt. & Pwr. Co., Abilene, for a franchise to furnish electrical service in Manchester.

OSBORNE, KAN.—The City Council is contemplating the purchase of a 150-hp. engine and also increasing the water-storage capacity by erecting another tank. J. H. Meiers is superintendent.

PRESTON, KAN.—The proposal to establish a municipal electric-light plant, to cost about $15,000, in Preston is under consideration.

SPEARVILLE, KAN.—The purchase of the local electric-lighting plant, to be owned and operated by the municipality, is under consideration.

## Southern States

GOLDSBORO, N. C.—The Goldsboro Pwr. & Lt. Co. is installing a 1000-kva. General Electric Curtis horizontal turbo-generator, three-phase, 60 cycles, 2300 volts, with jet condenser. E. G. Couch is local manager.

LEAKSVILLE, N. C.—The Leaksville Lt. & Pwr. Co. will erect and equip a new central station. Energy to operate its system will be purchased from the Southern Pwr. Co., Charlotte. The new station will be equipped for distributing about 600 kw.

MADISON, N. C.—The installation of a municipal electric-light plant is under consideration by the city of Madison.

MAXTON, N. C.—The Carolina El. Co., Maxton, expects to put in a stock of storage batteries and repairs. The company will be in a position for battery charging in a short time. Equipment has been purchased. E. P. Williams is assistant general manager.

MOUNT AIRY, N. C.—During this year the Water and Light Commission expects to begin the construction of an additional hydroelectric generating plant. This will include construction of dam and power house, new equipment consisting of generator, waterwheel, switchboard panel, governor, and 2½ miles of transmission lines. About 300 hp. will be developed. I. W. Barber is superintendent.

NORWOOD, N. C.—The city of Norwood is considering the installation of an electric-lighting system. The Southern Pwr. Co., Charlotte, it is understood, is planning to

extend its transmission line from Albemarle to Norwood.

ROXBORO, N. C.—The Roxboro Lt. & Pwr. Co. expects to change its ice plant from steam to electric drive and contemplates the purchase of the following equipment: Two 20-kva. transformers, one 20-hp., one 5-hp., one 3-hp. and one ¼-hp. motor, one 50-gal.-per-minute triplex pump and one 29-gal.-per-minute triplex pump. M. R. Long is secretary and treasurer.

WILMINGTON, N. C.—Plans for power house for the James Walker Hospital have been prepared by Kenneth M. Murchison, 101 Park Avenue, New York, N. Y.

WILMINGTON, N. C.—The Tidewater Pwr. Co., Wilmington, is contemplating the installation of a 520-hp. boiler, one 2000-kw. steam-driven unit and extension to boiler room. Raymond Hunt is assistant general manager.

CONWAY, S. C.—The Quattlebaum Lt. & Ice Co., Conway, has recently placed contracts for a 12-in. by 14-in. Skinner engine, directly connected to a 75-kva. Westinghouse generator. Paul Quattlebaum is president.

DILLON, S. C.—A new generating unit, consisting of a Harrisburg engine and General Electric generator, has recently been installed in the municipal electric-light plant. B. A. Bedenbaugh is secretary and treasurer.

LATTA, S. C.—The City Commissioners, it is reported, have awarded a contract for the construction of a municipal electric plant in Latta.

WALHALLA, S. C.—The Walhalla Lt. & Pwr. Co. has recently installed an oil engine and generator for emergencies. W. A. Strother is secretary and treasurer.

COMMERCE, GA.—The city of Commerce is considering the installation of a municipal electric-lighting plant.

ELLAVILLE, GA.—The City Council is considering the question of issuing $5,000 in bonds for the installation of a municipal electric-light plant and water-works system inn Ellaville.

LAKELAND, FLA.—Bids will be received until March 27 for construction of reservoirs and building for new water-works and electric power station, piping, etc., for station.

OCALA, FLA.—Bids will be received by the City Council at the office of the city clerk until March 30 for construction of water-works system, electric light and power plant, etc., according to plans and specifications prepared by Twombly & Henney, engineers, 55 Liberty Street, New York, N. Y., copies of which may be obtained upon deposit of $10. Plans are on file in the office of the city clerk, Ocala, and the engineers, New York, N. Y.

BIRMINGHAM, ALA.—The City Commissioners are contemplating the purchase of an additional 300-kw. electric generating unit, consisting of a 2300-volt, 60-cycle, three-phase generator directly connected to engine, non-condensing. James Wheatley, city commissioner, is in charge of the municipal water and lighting plant.

DE QUEEN, ARK.—The De Queen Ice & Lt. Co. contemplates the installation of two oil engines having a combined rating of 125 hp. The cost is estimated at $20,000.

HUNTINGTON, ARK.—The capital stock of the Coal & Gas Belt El. Co., Huntington, has been increased from $75,000 to $85,000.

MINDEN, LA.—The Minden El. Lt. & & Pwr. Co. contemplates overhauling its lines and making a few extensions this spring. Most of the material has been purchased. James S. Maxwell is superintendent.

ALLEN, OKLA.—Application has been made to the City Council by P. L. Linebaugh, Duncan, for a franchise to install and operate an electric-light plant in Allen.

CHECOTAH, OKLA. — The Checotah Wtr., Lt. & Ice Co. is contemplating the installation of a 75-hp. natural-gas engine to drive a 75-kva. generator (belted). Pole-line equipment will be required necessary to change present line (3½ miles) from 2300 volts to 6600 volts, with proper transformers, to give from 100 hp. to 150 hp. at the end of line, which is used for pumping city water. The present wire will be used, but the company will want poles, high-tension insulation, etc. L. B. Griffing is secretary and manager.

COYLE, OKLA.—The City Council is reported to be contemplating the installation of an electric-light plant and water-works system. It is proposed to secure service from the C. A. & N. University at Langston.

FOSS, OKLA.—The electric-light commissioners are contemplating some line improvements and the purchase of two or three transformers. H. D. Cobb is superintendent.

McALESTER, OKLA.—The Choctaw Ry. & Ltg. Co. is reported to be contemplating the construction of a power plant.

WOODVILLE, OKLA.—At an election held recently the proposal to issue $8,000 in bonds for the installation of a municipal electric-light plant was defeated.

BALLINGER, TEX.—The commissioners' court has granted a franchise for cables to be laid from Ballinger to Winters and Miles and intermediate points. The Ballinger El. Lt. & Pwr. Co., recently organized, is interested in the project. M. F. Treadwell, Ballinger, is general manager of the company.

DALLAS, TEX.—The Texas Pwr. & Lt. Co., Dallas, is planning to erect an electric transmission line from Dallas to Forney.

DALLAS, TEX.—The directors of the Dallas (Tex.) Pwr. & Lt. Co. have authorized the sale of $200,000 in bonds, the proceeds to be used for extensions and improvements to its electric and power system.

EAGLE PASS, TEX.—The International El. Co., Eagle Pass, has increased its capital stock from $160,000 to $210,000, the proceeds to be used for improvements to its system.

HOUSTON, TEX.—The Houston Ltg. & Pwr. Co. is planning to install a 7500-kw. turbo-generator set.

HOUSTON, TEX.—Bids will be received by E. S. Bonney, city treasurer, until March 16, for furnishing pumps, electric motors, blowers and Diesel engines with all necessary appurtenances to be used in connection with sewage-disposal plant. E. E. Sands is city engineer.

ORANGE, TEX.—The Lutcher & Moore Lumber Co. has closed a contract with the Pawling & Harnischfeger Co., Milwaukee, for the installation of a monorail system (electrically operated) at its new mill soon to be erected in Orange. The Monorail system will be 24,000 ft. long and will include three hoists or carriers, 27 switches and other equipment.

SAN ANTONIO, TEX.—Arrangements are being made by the Meridian Highway Association for the installation of an electric-lighting system along the Meridian Road in Texas for a distance of more than 300 miles. The service will be furnished by the Texas Pwr. & Lt. Co., Dallas. D. E. Colp is president of the association.

## Pacific States

SALEM, ORE.—A permit has been granted by State Engineer Lewis to H. L. Ross of Baker, it is reported, for the use of one second-foot of water from Elk Creek for the development of 120 hp., to be used for mining purposes near Cornucopia. The cost of the development is estimated at $6,000.

ONTARIO, ORE.—Ontario, it is reported, is to be made the central distributing point of the Electric Investment Co. for southwestern Idaho and eastern Oregon. The transmission lines from Horseshoe Bend, Boise, Swan Falls and Oxbow, Idaho, will converge at this point. Repairs will be made at once to the transmission lines serving New Plymouth and Emmett, Idaho. The Ontario office will be in charge of W. L. Hall.

MACKAY, IDAHO.—The Mackay Lt. & Pwr. Co. is installing a new impulse wheel. J. D. Carr is secretary and manager.

MONTOUR, IDAHO.—A power plant is being installed near Montour by L. A. Wilson, Montour, and J. A. Armstrong, Walla Walla, Wash. The proposed plant will supply electricity for pumping water to irrigate about 2000 acres in this vicinity and for lighting purposes in Montour and Sweet.

KINGMAN, ARIZ.—The Desert Pwr. & Wtr. Co., Kingman, is contemplating extending its 44,000-volt service to the Big Jim Gold Mines and to Bluebird Templar Mine by extension of the Black Eagle transmission line from Oatman; also rebuilding the Ruth 44,000-volt line and an extension to the United Eastern pumping station. The company is purchasing equipment for 3½ miles of line. R. W. Wilde is vice-president.

OATMAN, ARIZ.—Application has been made by D. L. Mayhew and associates for franchises to supply light, heat and power in the town of Oatman and vicinity. They propose to erect an electric power plant and gas plant and also plan to construct an electric railway for Topock into the Oatman district.

PUEBLO, COL.—Plans, it is reported, have been completed for a new boiler and power house (100 ft. by 130 ft.) for the State Insane Asylum. F. W. Cooper is architect.

CARLSBAD, N. M.—Improvements are being made to the system of the Public Utilities Co., Carlsbad, including the installation of a 300-kw., three-phase, 2300-volt generator (ordered but not yet installed); changing transmission line (6 miles long) from single-phase, 2300 volts, to three-phase, 6600 volts, using three transformers at each end; building a concrete substation in town, equipped with new switchboard, transformers, arresters, etc.; changing all motors to three-phase, 220 volts. Part of this work is completed and part under way. All material has been purchased. E. A. Roberts is manager.

## Canada

CALGARY, ALTA.—Bids will be received by the City Commissioners until March 15 for furnishing underground cable. Specifications are on file with the city electrical engineer. The City Council has granted an appropriation of $36,438 for power-house switching installation and $15,000 for electric light and power connection.

HALIFAX, N. S.—The Halifax El. Tramway Co. contemplates extensive improvements and extensions to its system during 1916, involving an expenditure of about $500,000, which will include a new gas plant, extensions to power house, installation of steam turbine, etc. W. J. De Blois is secretary and treasurer.

LUNENBURG, N. S.—Plans are being considered by the Lunenburg Gas Co. for the construction of another dam and power house on the river, about 1 mile above its present plant, which is situated at Cleveland, about 9 miles from Lunenburg. S. D. Herman is secretary and treasurer.

HAILEYBURY, ONT.—The Northern Ontario Lt. & Pwr. Co., Haileybury, it is reported, is planning to extend its transmission lines from Cobalt to Kirkland Lake, a distance of 70 miles.

INWOOD, ONT.—The Village Council is contemplating making arrangements to secure electricity from the Ontario Hydro-Electric Power Commission.

LISTOWEL, ONT.—The Listowel Water and Light Commission is planning a complete overhauling of all the lines, for which material has been purchased, except some line wire (No. 4 copper wire), lightning arresters and a small amount of hardware.

PARRY SOUND, ONT.—The city of Parry Sound is considering the installation of a 150-hp. motor and pump of about 500,000 gal. capacity, 125 lb. head; motor, three-phase, 60-cycle, 2200 volts, or same of 550 volts, and two 75-kva. transformers. Plans are being inaugurated to increase the sale of cooking, washing and all kinds of domestic electrical appliances. J. D. Broughton is treasurer.

TORONTO, ONT.—The works committee of the City Council has appointed a subcommittee to consider the entire street-lighting system of the city of Toronto.

PORTNEUF, QUE.—Tenders will be received by D. Beaubien, 28 Royal Insurance Co. Building, Montreal, it is reported, for the installation of a 500-hp. generating unit, consisting of a vertical waterwheel, generator, switchboard and general equipment, for the Portneuf Hydro-Electric Co., Portneuf.

DAWSON, Y. T.—The Canadian Klondyke Pwr. Co., Dawson, is contemplating the installation of an additional and separate hydroelectric plant, utilizing a static head of approximately 80 ft. For further information address J. W. Boyle, Dawson, general manager.

## Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 20 for furnishing steel angles, rivets, bolts, nuts, washers, malleable iron and steel castings, manganese steel pins, steel conduit, steel cable, electric cable and wire, shop machines, electric motors, transformers, switches, potheads, potential regulator, electrical attachments, voltmeters, ammeters, tachometers, hydrometers, terminal boards, slate slabs, oil pumps, cutting tools, etc. Blanks and general information relating to this circular (No. 1020) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

# Record of Electrical Patents

Notes on United States Patents issued Feb. 29, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,173,165. Lightning Arrester; L. S. Brach, New York, N. Y. App. filed April 9, 1913. Vacuum type. (Thirty-eight claims.)

1,173,190. Composite Conductor Cable and Method of Making the Same; W. Hoopes, Pittsburgh, Pa. App. filed Oct. 10, 1914. Steel core and aluminum envelope.

1,173,192. Elevator Signaling Apparatus; P. T. Kenny, New York, N. Y. App. filed Oct. 3, 1907. Elevator doors restore the push-buttons.

1,173,235. Elevator Safety System; G. S. Williamson, New York, N. Y. App. filed March 12, 1914. "Floor-light" mechanism.

1,173,239. Railway Signal Lantern; A. A. Ziegler, Boston, Mass. App. filed June 6, 1912. Extra lamp thrown in circuit when first lamp burns out.

1,173,240. Electromagnet; A. A. Ziegler, Boston, Mass. App. filed Jan. 20, 1913. Special construction for securing core to carrying plate.

1,173,254. Switch Selector; A. F. Dixon, Newark, N. J. App. filed Dec. 12, 1914. For printing-telegraph system.

1,173,260. Electric Switch; G. Griffith, Parsons, Kan. App. filed Aug. 9, 1915. For igniting blasting charges.

1,173,269. Signaling Device; C. Heidemann, St. Louis, Mo. App. filed Oct. 7, 1914. Signal lamp mounted in glove, for traffic policemen.

1,173,324. Spark-Gap Mechanism; D. M. Sweeney, San Francisco, Cal. App. filed July 19, 1915. Adapted to be movably attached to a spark plug.

1,173,332. Telephone Cable Box; K. F. Wincrantz, C. E. J. Nilson and C. F. Pettersson, Stockholm, Sweden. App. filed July 19, 1911. Terminal block secured to removable bottom of box.

1,173,334. Electrical Control Apparatus; R. Amberton, London, Eng. App. filed June 19, 1914. Adapts ordinary rheostat for automatic control.

1,173,370. Arc-Light Electrode; W. R. Mott, Lakewood, Ohio. App. filed June 13, 1914. Contains rare earth fluorides, thorium material and a conducting body.

1,173,394. Joining or Bonding the Junctions of Metallic Sheathing or Armoring of Electric Conductors; L. Sunderland, Westminster, London, Eng. App. filed Oct. 16, 1913. Connecting plates on ends of sheathing which are united to join sections of sheathing together.

1,173,400. Suspension Clamp; R. A. Willson, Spokane, Wash. App. filed Aug. 15, 1911. For high-tension work; constructed to prevent arcing.

1,173,409. X-Ray Apparatus; C. E. Campbell, Lynn, Mass. App. filed Aug. 7, 1915. Table for X-ray examinations.

1,173,438. Automatic Brake for Elevators; P. Keston, Nuremberg, and H. Osborne, Charlottenburg, Germany. App. filed May 6, 1913. For bringing heavy elevators to a stop at predetermined points.

1,173,452. Electric Condenser and Process of Making the Same; M. Meirowsky, Porz-on-the-Rhine, Germany. App. filed Nov. 30, 1914. Dielectric made of alternate layers of paper and synthetic rosin.

1,173,540. Portable Electro-Therapeutic Apparatus; J. E. Seeley, Los Angeles, Cal. App. filed Aug. 20, 1914. Divisibly constructed so that only the sections necessary need be carried.

1,173,560. Semi-Automatic Telephone Exchange System; H. P. Clausen, Mount Vernon, N. Y. App. filed July 6, 1914. Gives a reverting "busy test."

1,173,562. Radiotelephone Transmitting System; W. T. Ditcham, Twickenham, Eng. App. filed June 20, 1914. Discharge of spark-gap takes place between surfaces of small area in current of carbon dioxygen.

1,173,564. Operator's Calling Device; A. H. Dyson, Chicago, Ill. App. filed Feb. 23, 1911. For directly controlling automatic switches.

1,173,569. System of Distribution; F. W. Harris, Wilkinsburg, Pa. App. filed March 13, 1911. Circuit interrupter in each field circuit.

1,173,570. Electrolytic Measuring Instrument; H. S. Hatfield, Germany. App. filed June 22, 1914. Has an electrode of rhodium.

1,173,584. Mechanically Actuated Diaphragm Horn; J. W. Jones, New York, N. Y. App. filed June 23, 1911. Intermediate member interposed between diaphragm and operating cam.

1,173,592. Horn Cut-Out and Motor-Control Alarm for Motor Vehicles; D. A. McConnell, Arlington, N. J. App. filed Jan. 14, 1911. Horn cut-off of circuit when automobile is standing still.

1,173,593. Trolley-Operated Contact; J. F. McElroy (deceased), Albany, N. Y. App. filed April 29, 1912. Switch operated by trolley in passing along trolley wire.

1,173,598. Fuse Device; L. O. Meller, Evanston, Ill. App. filed March 3, 1913. Inclosed construction.

1,173,609. Electric Switch for Automatic Passenger-Fare-Registering Mechanism; H. Savage and W. L. Baker, San Antonio, Tex. App. filed June 10, 1913. Operated by passenger mounting car step.

1,173,621. Terminal Connector for Curling Irons and the Like; F. Thornton, Jr., Pittsburgh, Pa. App. filed May 1, 1913. Improved detachable construction.

1,173,630. Method and Means for the Production and Control of Current Impulses; C. I. Zimmerman (deceased), Madison, Wis. App. filed May 17, 1915. Obtains current impulses of much higher potential than the source without means external to the circuit.

1,173,632. Circuit Interrupter; C. Aalborg, Wilkinsburg, Pa. App. filed June 28, 1911. Rigid durable construction of the "resistance" type.

1,173,641. Turning Signal for Automobiles; J. J. Barrett, Maspeth, N. Y. App. filed Feb. 18, 1915. Two swinging signaling arms carrying light bulbs.

1,173,642. Equalizer Yoke; W. E. Belcher, Washington, D. C. App. filed March 13, 1915. Embodies a steel plate bent to form a yoke.

1,173,651. Storage Battery; W. A. Crowdus, Chicago, Ill. App. filed April 22, 1915. Constructed after the manner of a dry cell.

1,173,655. Phantom Circuit; F. H. Fay, New York; T. Shaw, Hackensack, N. J., and J. J. Pillod, Chicago, Ill. App. filed Oct. 7, 1914. Embodies a phantom-forming device connecting side circuits and their extensions and an auto-transformer in series with side circuits and extensions.

1,173,657. Alternating-Current System; L. Fleischmann, Berlin, Germany. App. filed April 29, 1913. Automatic adjustment of circuit constants in response to changes in generator's speed.

1,173,673. Electro-Pneumatic Air-Brake System; G. Macloskie, Schenectady, N. Y. App. filed July 31, 1913. Secures greater certainty and rapidity of operation. (Thirty-nine claims.)

1,173,679. System for Producing High-Frequency Oscillations; M. Osnos, Berlin, Germany. App. filed Feb. 3, 1914. Renders operation attended with little danger.

1,173,699. Electrical Flame-Arc Furnace for Oxidizing the Nitrogen of the Air; H. Bonnevie, Rjukan, Norway. App. filed Nov. 30, 1915. Simultaneously cools the resulting gases and utilizes heat of same.

1,173,702. Telegraph Transmitter; C. Bell, Centralia, Mo. App. filed June 21, 1915. Provision for producing a series of dots.

1,173,711. Circuit Coupling; H. A. Douglas, Bronson, Mich. App. filed June 28, 1913. Plug-and-socket construction, bayonet joint.

1,173,754. Automatic Recorder for Telephone Messages; H. G. Stalker, Navan, Ontario, Canada. App. filed Feb. 15, 1914. Attachable to ordinary telephone.

1,173,764. Automatic Valve-Operating Mechanism; I. M. Baldwin, Wellsburg, N. Y, App, filed Feb. 17, 1914. Mechanism for operating valve from a thermostat.

1,173,772. Telephony; E. R. Corwin, Chicago, Ill. App. filed April 5, 1913. Devices for interchangeably connecting idle calling-line extensions with calling lines.

1,173,773. Telephony; E. R. Corwin, Chicago, Ill. App. filed April 5, 1913. Links connectors and electromagnetic switches.

1,173,774. Telephony; M. L. Johnson, Chicago, Ill. App. filed April 5, 1913. "Prepayment" equipment.

1,173,775. Telephony; M. L. Johnson, Chicago, Ill. App. filed July 17, 1913. Recording operators may select idle toll-board operators.

1,173,776. Telephony; E. R. Corwin, Chicago, Ill. App. filed Jan. 15, 1915. Guards against extension of accidentally grounded telephone wires.

1,173,777. Telephony; E. R. Corwin, Chicago, Ill. App. filed April 7, 1915. Calling lines may be connected with further calling-line extensions.

1,173,778. Elevator Governor; A. M. Coyle, New York, N. Y. App. filed April 26, 1912. Prevents elevator gaining excessive speed.

1,173,788. Baseball-Game Exhibitor; E. E. Fairchild, Los Angeles, Cal. App. filed Feb. 3, 1914. Exhibits play by flashing lamps.

1,173,791. Combined Fuse and Switch Box; E. Frye, Dorchester, Mass. App. filed May 19, 1915. For outside installations.

1,173,803. Electric-Light Socket; P. M. Hotchkin, Chicago, Ill. App. filed May 22, 1912. Applicable to outlet box.

1,173,804. Offset Floor Fitting and Connection; P. M. Hotchkin, Chicago, Ill. App. filed Nov. 23, 1914. For lighting showcases.

1,173,874. Record-Punching Machine; S. Scognamillo, New York, N. Y. App. filed July 10, 1914. For making player-piano records.

1,173,889. Ventilating Washer for Knife-Blade Fuses; J. W. Steelman, Philadelphia, Pa. App. filed Jan. 27, 1915. Can be applied to ventilate any type of knife-blade fuse.

1,173,922. Automatic Signaling Device; C. L. Bopp, Hawkeye, Iowa. App. filed June 30, 1911. Automatic railway signaling.

1,173,945. Burglar-Alarm Apparatus; W. H. Gabel, Kintyre, N. D. App. filed Aug. 11, 1914. Embodies special alarm and main circuits.

1,173,957. Wireless Telegraphy or Telephony; W. Hahnemann, Kiel, Germany. App. filed Feb. 10, 1913. Uses two pairs of sub-electrodes or ground electrodes.

1,173,960. Electric Furnace; I. Hechenbleikner, Charlotte, N. C. App. filed Nov. 2, 1914. For treatment of phosphate to expel phosphate acid.

1,173,962. Electric Fuse; W. D. Hensell, Waverley, near Sydney, New South Wales, Australia. App filed June 17, 1914. Rotary fuse holder serves to draw fresh length of fuse into operative position.

1,173,965. Galvanic Battery; W. Hickmann, Frankfort-on-the-Main, Germany. App. filed May 10, 1911. Acid manganite acts as depolarizer.

1,173,984. Portable Electric Lamp; F. M. Rosenfeld, New York, N. Y. App. filed March 5, 1915. Guards against short-circuiting of battery cell.

1,173,994. High-Tension Insulator; S. Barfoed, Oakland, Cal. App. filed Aug. 18, 1914. Constructed to prevent temperature stress in bottom of insulator.

1,174,002. Insulator; V. P. Ettinger, Kansas City, Mo. App. filed Jan. 20, 1915. Eliminates need for bindery wires.

1,174,006. Thermostatic Circuit-Breaking Apparatus for Electrical Heaters; J. E. Harvey, Milton, Mass. App. filed April 3, 1915. Applied to sterilizing apparatus.

1,174,025. Heating Unit for Meters; H. N. Packard, Milwaukee, Wis. App. filed July 17, 1914. Fluid meter.

1,174,027. Electric-Circuit Terminal; J. Amon, New York, N. Y. App. filed Jan. 28, 1913. Improved rigid terminal-pin construction.

1,174,029. Telegraphy; W. Finn, Bloomfield, N. J. App. filed Nov. 6, 1915. Transmitting relay.

1,174,030. Electric Stove; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Jan. 28, 1913. Of high thermal efficiency.

1,174,031. Electric Stove; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Jan. 28, 1913. Two heating conducting plates spaced by heating units.

1,174,032. Electric Heater; W. S. Hadaway, Jr., New Rochelle, N. Y. App. filed Feb. 11, 1913. Improved method of internally uniting metallic resistor carrier to body to be heated.

14,076 (reissue). Electric Controller; A. C. Eastwood, Cleveland, Ohio. App. filed July 11, 1913. (Original patent No. 1,013,754, filed Jan. 2, 1912.) Interlocking motor-controlling switches.